

oject:

ENORASIS

(Grant Agreement 282949)

“ENVIRONMENTAL OPTIMIZATION OF IRRIGATION MANAGEMENT WITH THE COMBINED USE AND INTEGRATION OF HIGH PRECISION SATELLITE DATA, ADVANCED MODELING, PROCESS CONTROL AND BUSINESS INNOVATION”

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D5.2: ENORASIS User Manual

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1. EXECUTIVE SUMMARY

This deliverable contains the ENORASIS user manuals presenting in detail the functionalities of the system and guiding its users through the different modules that were developed by the consortium during WPs 3, 4, and 5. The manuals in this deliverable refer to the final system and were written in English. Screenshots were also taken from the English version of the various applications developed for ENORASIS.

A detailed user manual is provided for each created application that provides a "User interface" which are:

1. Web application
2. Middleware
3. DSS based on GIS (GIS dashboard)
4. Android application

2. WEB APPLICATION

The ENORASIS web application can be accessed through the URL <http://app.enorasis.eu/> using any web browser.

Home screen is shown in Figure 1. ENORASIS project is described in a few sentences and the Users have two options, to login in order to access the web application or to register and get a new account.



Figure 1 – Home screen

The *About the Project* menu button will lead you to the ENORASIS Project web site.

2.1 Registration

Registration form is shown Figure 2. In order to register, the User need to fill all required fields:

- Name
- E-mail
- Password
- Retype password
- Phone
- User type

If any filed remain empty, *Save changes* button will not take action.

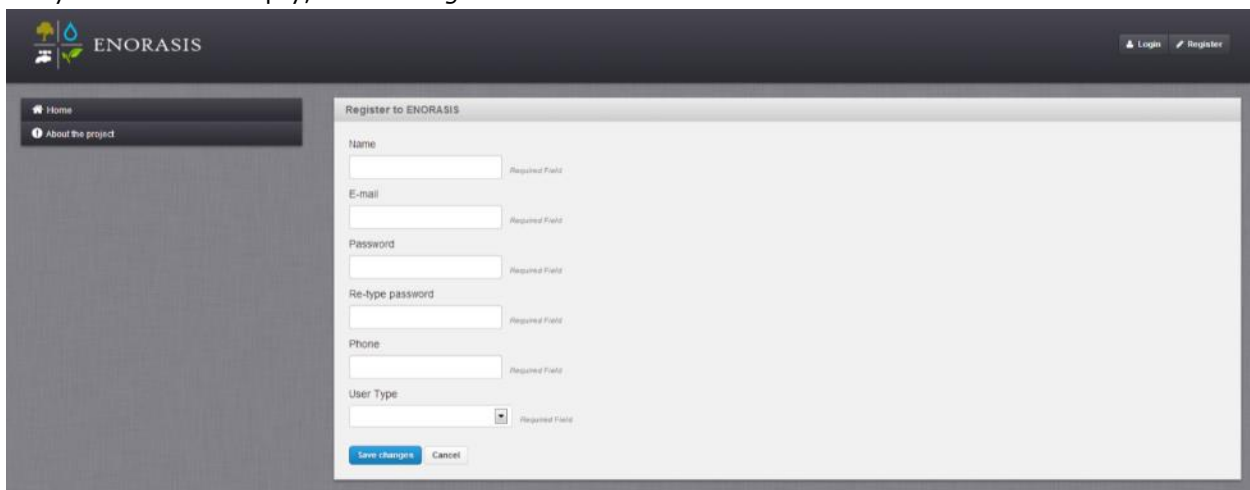
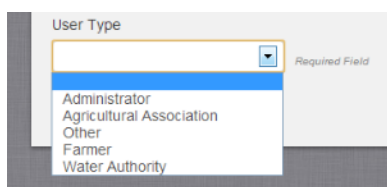


Figure 2 – Registration form

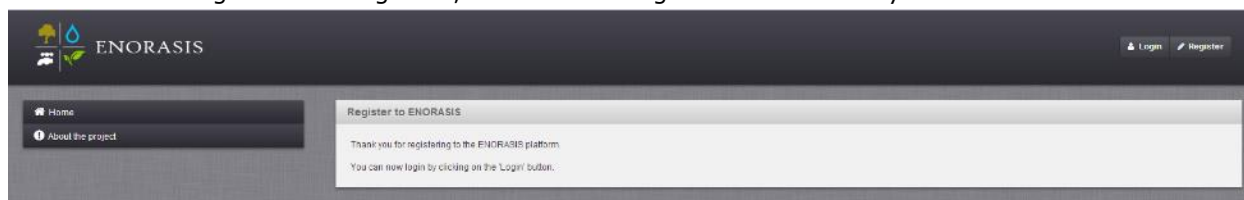
The User can select one of the predefined options for *User Type* – shown on Figure 3.



A dropdown menu titled "User Type" with a "Required Field" label. The menu is open, showing the following options: Administrator, Agricultural Association, Other, Farmer, and Water Authority.

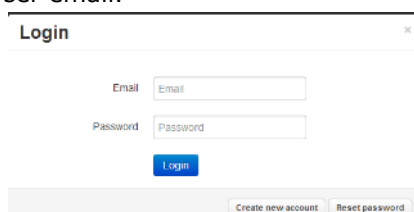
Figure 3 – User Type options

After successful registration - Figure 4, the User can log in to ENORASIS system.

**Figure 4 – Confirmation message of successful registration**

2.2 Login screen

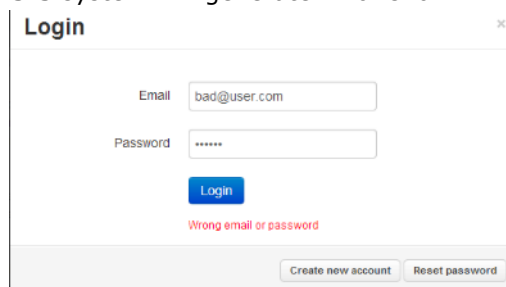
In order to access ENORASIS system the User need to provide correct email and password. If the User has forgotten his/her valid password, he/she can reset password by clicking on *Reset password* button. New password will be sent on the User email.



The login form is titled "Login" and includes two input fields: "Email" and "Password". Below the fields is a blue "Login" button. At the bottom of the form, there are two links: "Create new account" and "Reset password".

Figure 5 – Login form

If credentials are wrong, ENORASIS system will generate Error shown in Figure 6.



The login form is shown with an error message. The "Email" field contains "bad@user.com" and the "Password" field contains "*****". Below the fields is a blue "Login" button. A red error message "Wrong email or password" is displayed below the button. At the bottom, there are links for "Create new account" and "Reset password".

Figure 6 - Login error

The User may choose to create a new account by clicking on *Create new account* button. New account procedure is already described in chapter 2.1. The User may also reset password in case that he/she has forgotten it. A new password will be send on e-mail by pressing the *Reset password* button.

2.3 Successful login

After successful login to the system the screen appears as shown in Figure 7 in case that you are a regular User or Figure 8 if you are an administrator.

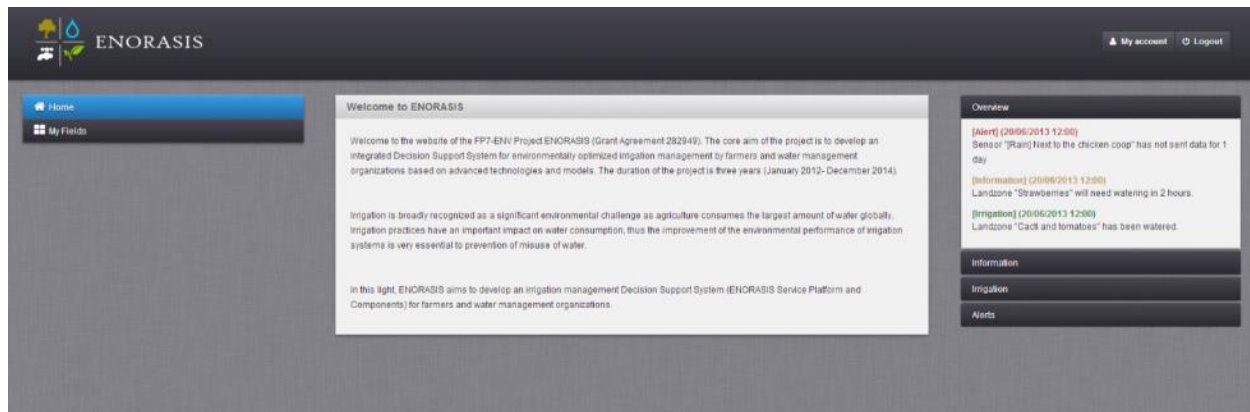


Figure 7 – Home screen of successful login – regular User

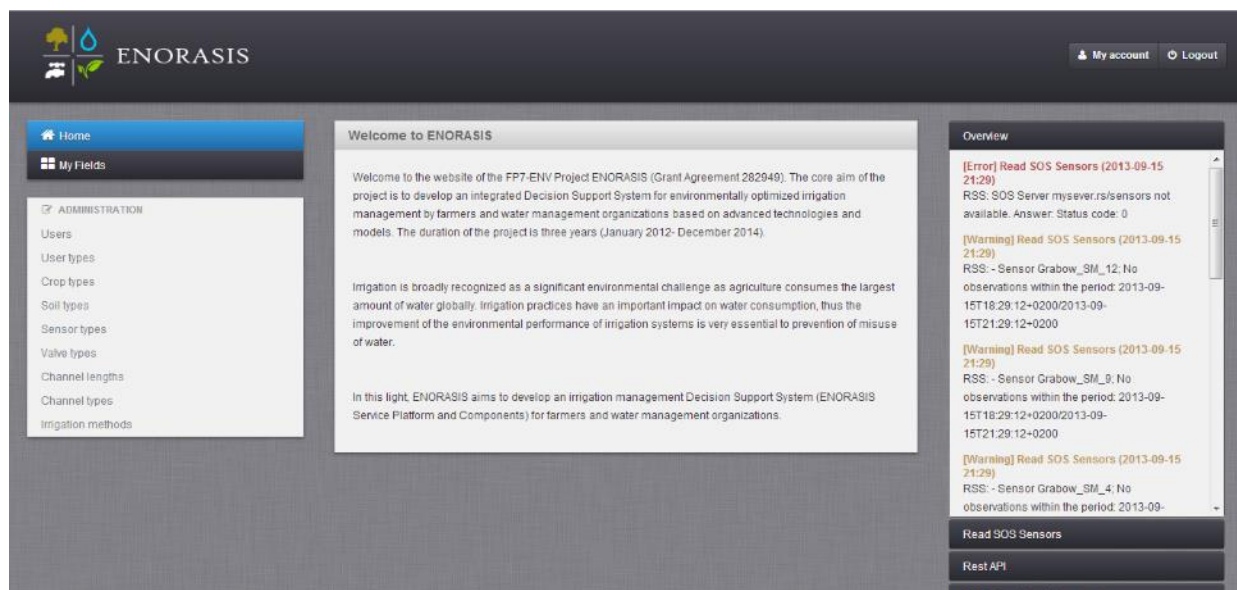


Figure 8 - Home screen of successful login - admin User

By clicking on the *My account* button in the top right corner, the User has the ability to change his/her profile data - Figure 9

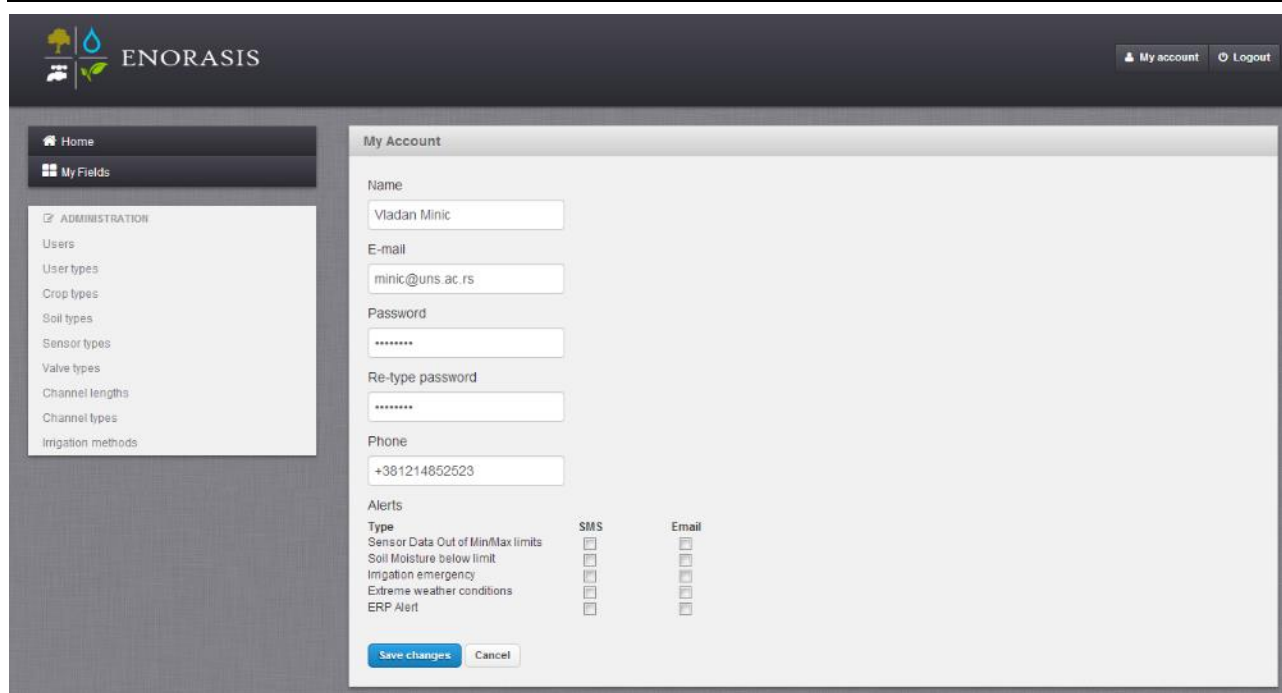


Figure 9 - My Account

2.4 Generic UI and functionalities

After successful login the accordion right menu will appear showing brief information for the following options:

- Overview - Figure 10
- Read SOS sensors - Figure 11
- DSS executions - Valves actions - Figure 12
- Universal connector - **Error! Reference source not found.**
- Rest API - Figure 13
- DSS Calculations - Figure 14

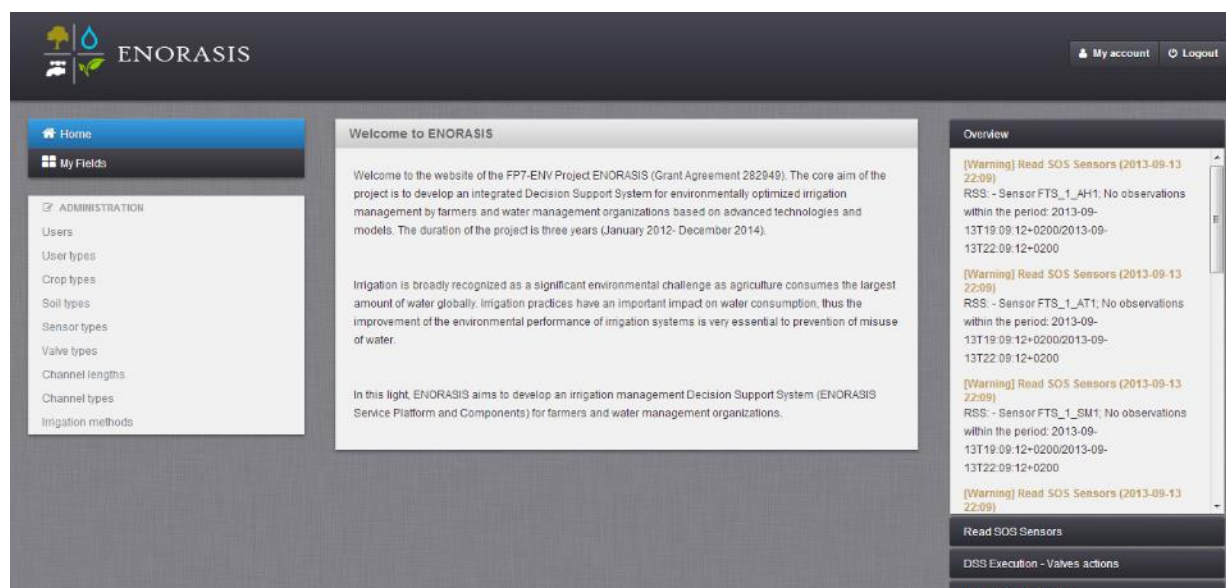
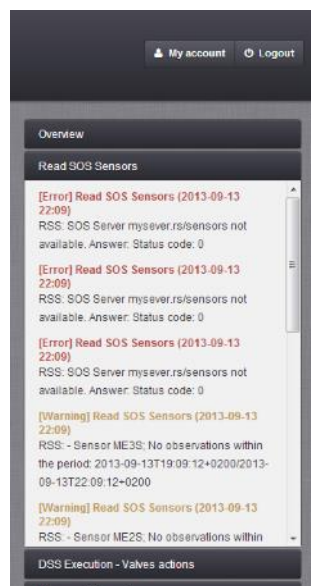
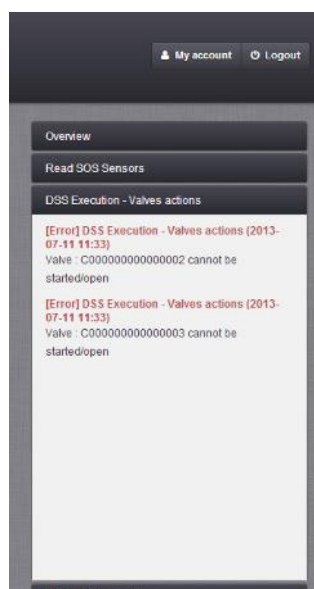


Figure 10 - Overview

**Figure 11 - Read SOS Sensors****Figure 12 - DSS Execution - Valves actions**

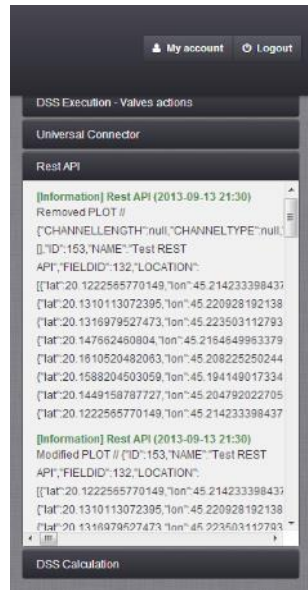


Figure 13 - Rest API

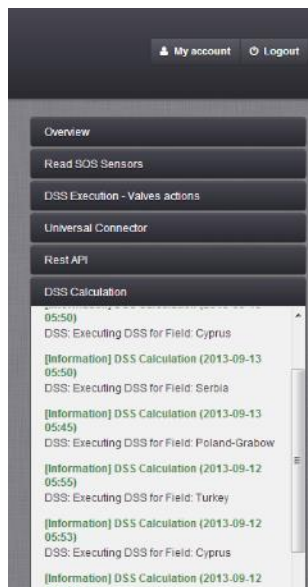


Figure 14 - DSS Calculation

One of the most important parts of this web application is the map - Figure 15. User can choose between different levels of layers by clicking on the cross sign in the right corner of the map and checking/unchecking appropriate boxes - Figure 16.



Figure 15 – Map



Figure 16 - Map options

Zooming in and zooming out can be done by clicking on the "+" and "-" signs in the left corner, or by scrolling the mouse - Figure 17. User can move the map by clicking and dragging the map to the wanted position.



Figure 17 - Map zooming

2.5 Crop types management (admin)

The system administrator has the ability to create, edit or delete the Crop type.

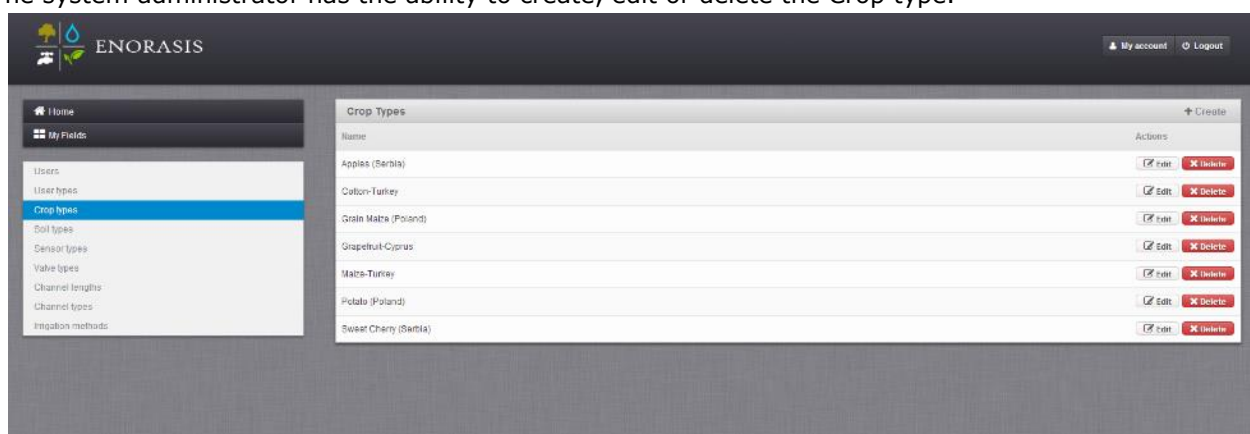


Figure 18 - Crop types management

The *Create* button is located in the top right corner - Figure 18. The Create form design is shown in Figure 19.

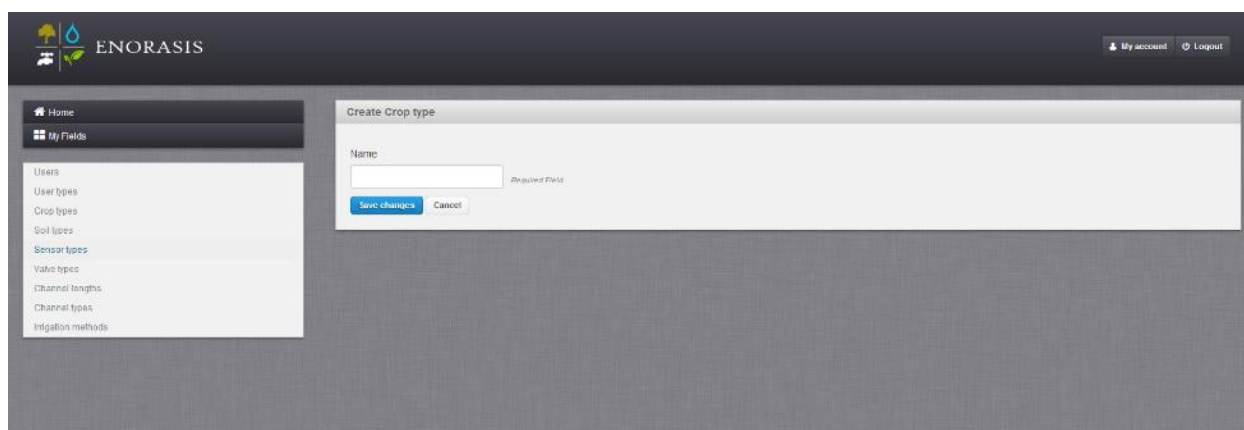


Figure 19 – Create Crop type

The only field which needs to be entered is the Crop name.

The administrator can change the Crop type by clicking on the *Edit* button located at the end of the line with the Crop name.

The Crop can be deleted by the administrator by clicking on the *Delete* button. Message "Are you sure you want to delete this record" will appear on the screen – Figure 20. The administrator needs to confirm his decision by pressing the *Delete record* button.

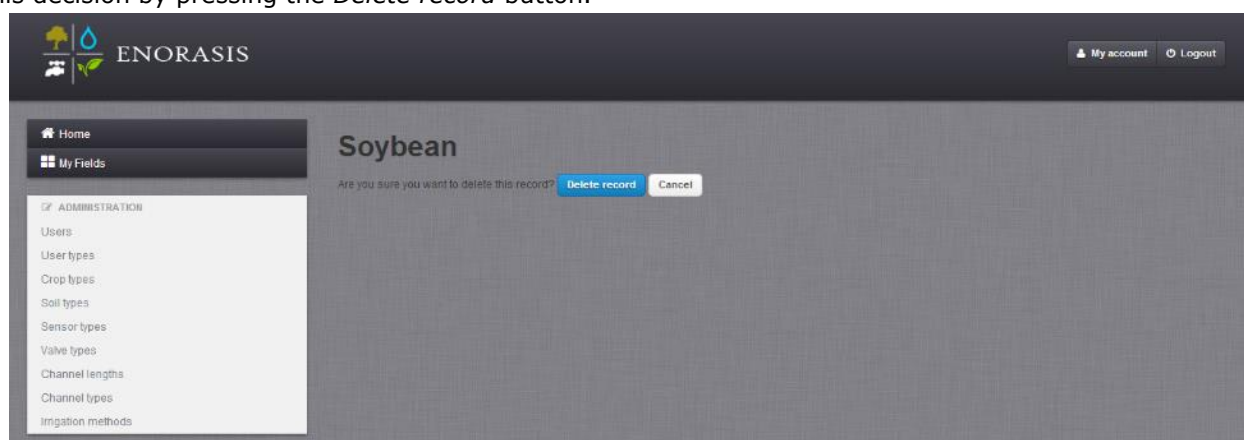
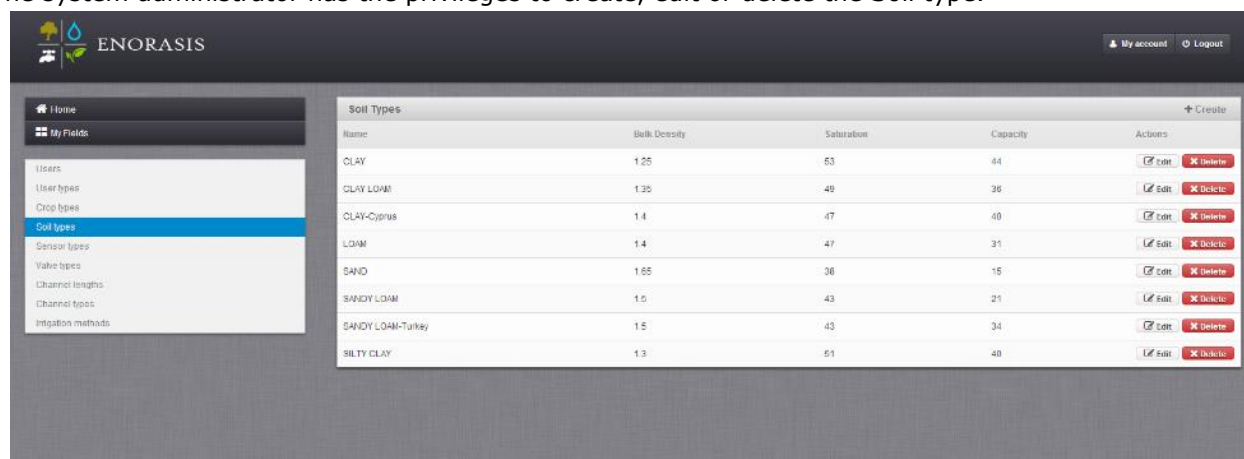


Figure 20 – Delete Crop type

2.6 Soil types management (admin)

The system administrator has the privileges to create, edit or delete the Soil type.



Name	Bulk Density	Saturation	Capacity	Actions
CLAY	1.25	63	44	Edit Delete
CLAY LOAM	1.35	49	36	Edit Delete
CLAY-Cyprian	1.4	47	40	Edit Delete
LOAM	1.4	47	31	Edit Delete
SAND	1.65	36	15	Edit Delete
SANDY LOAM	1.5	43	21	Edit Delete
SANDY LOAM-Turkey	1.5	43	34	Edit Delete
SILTY CLAY	1.3	51	40	Edit Delete

Figure 21 – Soil types management

The Create button is located in the top right corner - Figure 21. The Create form design is shown in Figure 22.

All form fields are required:

- Name
- Bulk Density
- Saturation
- Capacity

The administrator can change the Soil type data by clicking on the *Edit* button, which is located at the end of the line of its Soil type's name.

The Soil type can be deleted by the administrator by clicking on the *Delete* button. Message "Are you sure you want to delete this record?" will appear on the screen – Figure 23. The administrator needs to confirm his decision by pressing the *Delete record* button.

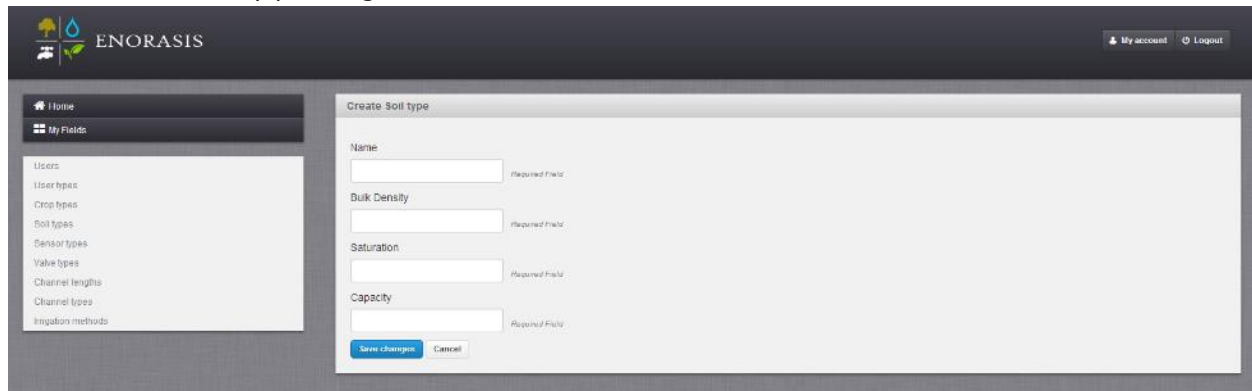


Figure 22 – Create Soil type

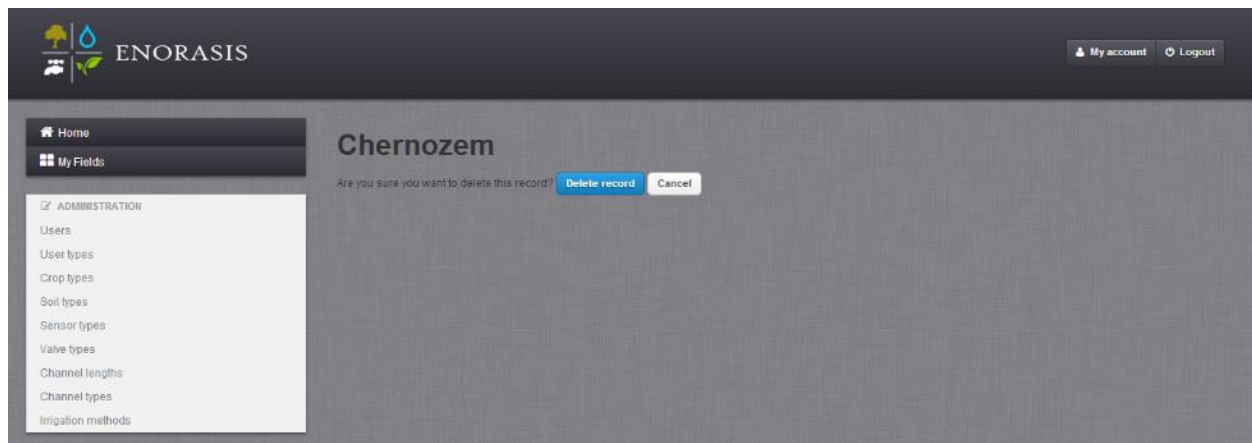
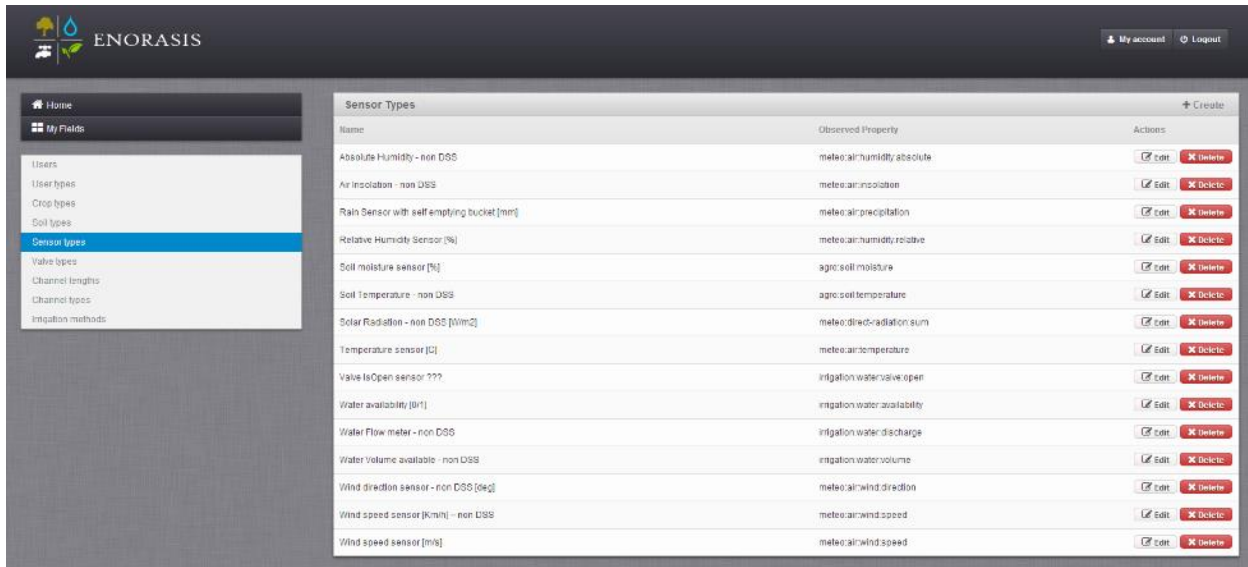


Figure 23 – Delete Soil type

2.7 Sensor types management (admin)

The system administrator has the ability to create, edit or delete the Sensor type.



Name	Observed Property	Actions
Absolute Humidity - non DSS	meteo:air:humidity:absolut	Edit Delete
Air Insulation - non DSS	meteo:air:insulation	Edit Delete
Rain Sensor with self emptying bucket [mm]	meteo:air:precipitation	Edit Delete
Relative Humidity Sensor [%]	meteo:air:humidity:relative	Edit Delete
Soil moisture sensor [%]	agro:soil:moisture	Edit Delete
Soil Temperature - non DSS	agro:soil:temperature	Edit Delete
Solar Radiation - non DSS [W/m ²]	meteo:direct-radiation:sum	Edit Delete
Temperature sensor [C]	meteo:air:temperature	Edit Delete
Valve Is Open sensor ???	irrigation:water:valve:open	Edit Delete
Water availability [l/h]	irrigation:water:availability	Edit Delete
Water Flow meter - non DSS	irrigation:water:discharge	Edit Delete
Water Volume available - non DSS	irrigation:water:volume	Edit Delete
Wind direction sensor - non DSS [deg]	meteo:air:wind:direction	Edit Delete
Wind speed sensor [km/h] - non DSS	meteo:air:wind:speed	Edit Delete
Wind speed sensor [m/s]	meteo:air:wind:speed	Edit Delete

Figure 24 - Sensor types management

The *Create* button is located in the top right corner - Figure 24. Create form design is shown in Figure 25. The required fields are:

- Name
- Observed Property

The administrator can change the User data by clicking on the *Edit* button located at the end of the line of its sensor type's name.

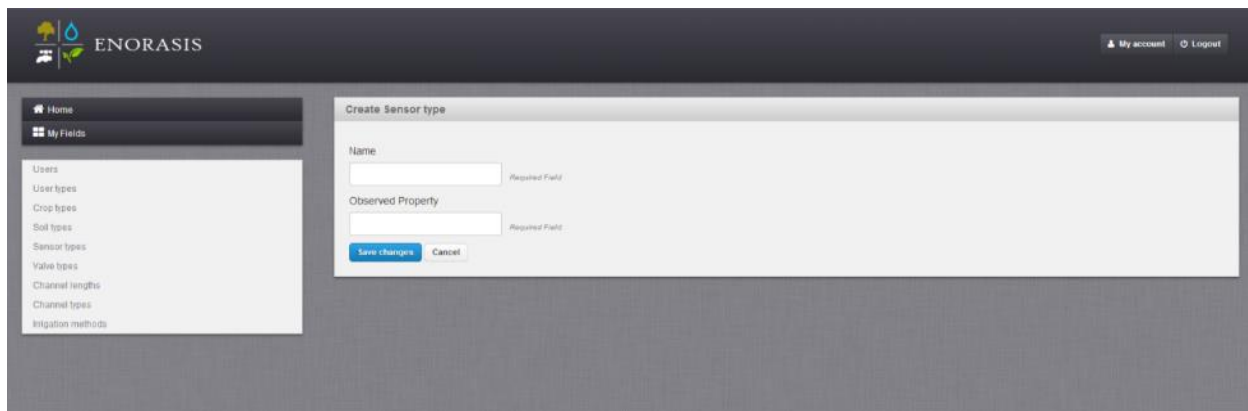


Figure 25 - Create Sensor type

The Sensor type can be deleted by the administrator by clicking on the *Delete* button. Message "Are you sure you want to delete this record?" will appear on the screen – Figure 26. The administrator needs to confirm his decision by pressing the *Delete record* button.

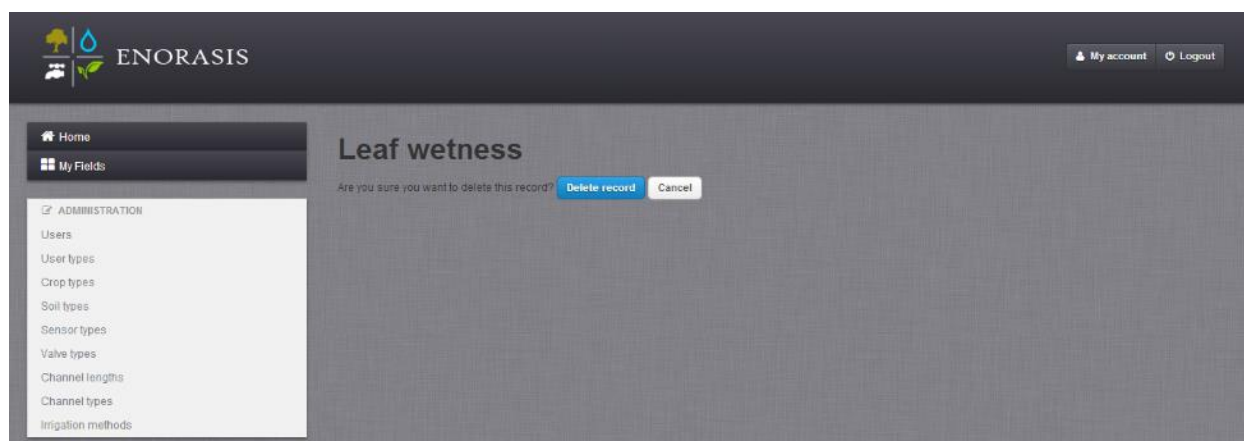


Figure 26 – Delete Sensor type

2.8 Users management (admin)

The system administrator has privileges to create, edit or delete the User. The Users management page is shown in Figure 27.

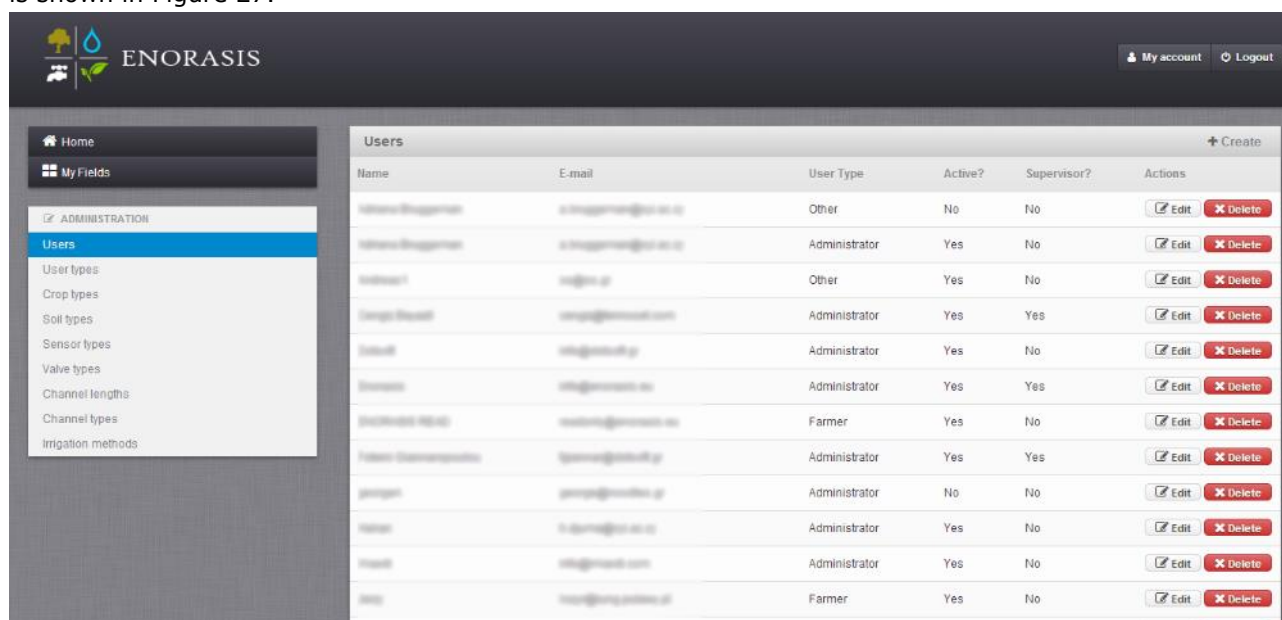


Figure 27 – User management

The *Create* button is located in the top right corner - Figure 27. The *Create User* procedure is the same as the *Registration* procedure described in chapter 2.1.

The administrator can change the User data by clicking on the *Edit* button located at the end of the line with the name of the User.

The User can be deleted by the administrator by clicking on the *Delete* button. Message "Are you sure you want to delete this record?" will appear on the screen – Figure 28. The administrator needs to confirm his decision by pressing the *Delete record* button.

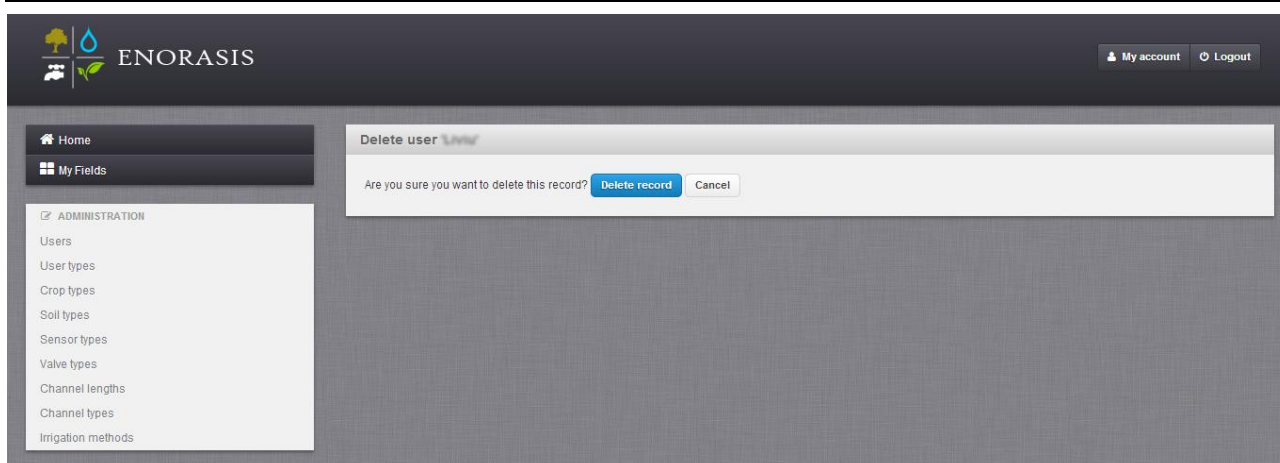


Figure 28 – Delete confirmation

2.9 Insert/Update Field

The User can create and update the Fields by clicking on the *My Fields* menu option, the *My Fields* grid will appear as shown in Figure 29.

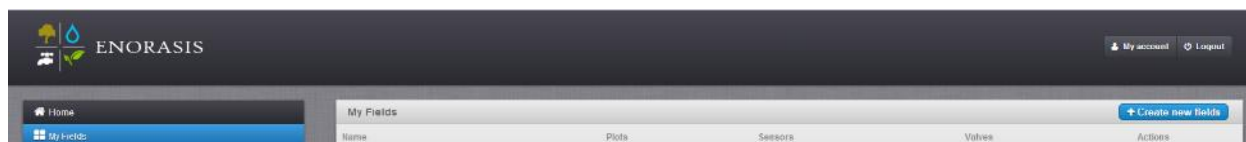


Figure 29 – My Fields

In order to create a new field, the User needs to click on the *Create new field* button in the right corner of the screen. New *Create Field* form will appear as shown in Figure 30. The User is expected to draw the shape of the field on exact location by clicking on the *Draw* button located under the map. The required fields are:

- *Name*
- *Size*

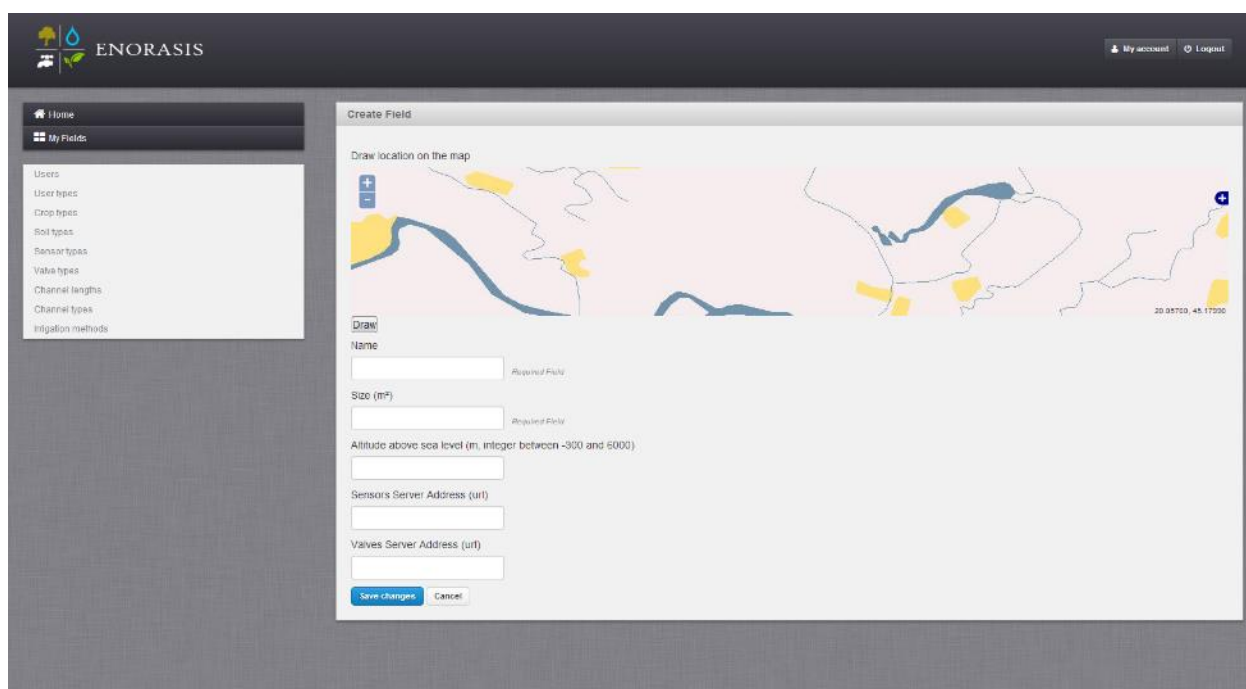


Figure 30 – Create Field

Optional fields are:

- Altitude above sea level
- Sensors server address
- Valves server address

Drawing the Field is very simple. The User needs to place the mouse cursor at the desired place and to click on the left mouse button. When the shape of the Field is satisfactory the User just needs to double click on the left mouse button. In the *Modify* mode - Figure 31 – the User can change the shape of the Field by clicking on desired point and dragging it to the correct place. If any of points is unnecessary the User can simply delete it by placing mouse cursor over that point and clicking the Delete button on the keyboard.



Figure 31 – Drawing the field

If the User selects and drags the light colored point, then a new one will appear in the middle of the line, between light colored point and its neighbors and light colored point will become darker.

When the User is satisfied with the shape and position of the field he/she just needs to press the *Done* button or the *Reset* button if he/she is completely unsatisfied.



Figure 32 – Drawing finished

If any changes need to be done the User can again switch to the *Modify* mode by clicking on the *Modify* button.

The new field will appear in the *My Fields* grid - Figure 33.



Figure 33 – My Fields

If the User is the owner of the Field he/she can also delete the field by clicking on the *Delete* button located at the end of the line of its field's name.

2.10 Field view

In order to view the specific Field, the User needs to select the *My Fields* in the menu and then to select an appropriate Field. Web application will show five grids: Map of the Field, Related Plots, Related Sensors, Related Valves and Field Permissions as shown in Figure 34.

Home

My Fields

Apple orchard

Cyprus

Poland-Grabow

Serbia

AG1

C1

Turkey

ADMINISTRATION

Users

User types

Crop types

Soil types

Sensor types

Valve types

Channel lengths

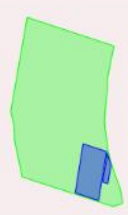
Channel types

Irrigation methods

Serbia

+

-



Name: Serbia

Altitude: 150

Sensors Server Address:

Valves Server Address: http://e.panonit.com:8085

Related Plots

AG1

OFF

9 Sensors

1 Valves

Edit

Delete

C1

OFF

7 Sensors

1 Valves

Edit

Delete

Related Sensors

FTS_1_AH1

Relative Humidity Sensor [%]

2013-09-08 09:11:28

Edit

Delete

FTS_1_AT1

Temperature sensor [C]

2013-09-08 09:11:28

Edit

Delete

FTS_1_PP1

Rain Sensor with self emptying bucket [mm]

2013-09-08 09:11:28

Edit

Delete

FTS_1_SM1

Soil moisture sensor [%]

2013-09-08 09:12:25

Edit

Delete

FTS_1_SM2

Soil moisture sensor [%]

2013-09-08 09:12:25

Edit

Delete

FTS_1_WD1

Wind direction sensor - non DSS [deg]

2013-09-08 09:11:28

Edit

Delete

FTS_1_WS1

Wind speed sensor [Km/h] - non DSS

2013-09-08 09:11:28

Edit

Delete

FTS_2_SM1

Soil moisture sensor [%]

2013-09-08 18:08:50

Edit

Delete

FTS_2_SM2

Soil moisture sensor [%]

2013-09-08 18:08:51

Edit

Delete

FTS_3_SM1

Soil moisture sensor [%]

2013-09-08 18:11:16

Edit

Delete

FTS_3_SM2

Soil moisture sensor [%]

2013-09-08 18:11:17

Edit

Delete

Related Valves

Test Serbia 2

Standard

Edit

Delete

Test Serbia valve

Standard

Edit

Delete

Field Permissions

Assign

Name

Email

Role

Approved

Actions

Dotssoft

info@dotssoft.gr

READ ONLY

Yes

Delete

Imaxdi

info@imaxdi.com

OWNER

Yes

Delete

Enorasis

info@enorasis.eu

OWNER

Yes

Delete

ENORASIS READ

readonly@enorasis.eu

READ ONLY

Yes

Delete

stefes

stavros@dotssoft.gr

READ-WRITE

Yes

Delete

Vladan Minic

minic@uns.ac.rs

READ-WRITE

Yes

Delete

Cengiz Bayazit

cengiz@teknoset.com

READ-WRITE

Yes

Delete

Jerzy

kozyn@iung.pulawy.pl

READ ONLY

Yes

Delete

Figure 34 – Field view

The Map of the Field shows all the details about the Field. The User has two buttons: Edit for editing the shape and the field details and Delete button to delete the selected Field.

The *Related Plots* grid offers the possibility to the User to turn on/off automatic irrigation, create, edit or delete the plot, or to click on the name of the plot and view the plot.

The *Related Sensors* and the *Related Valves* are similar with their functionalities. The User can create, edit or delete the sensor/valve, or to click on the name of the sensor/valve and view them.

The User can use the *Field Permissions* to give a privilege to any User to Read/Write or just to Read selected plot.

2.11 Insert/Update Plot

In order to create the Plot, the User needs to select the Field where the Plot is located and to click on the *Create* button in the *Related Plots* grid - Figure 35

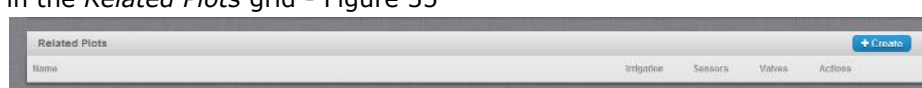


Figure 35 – Related Plots

The User is expected to draw the shape of the field on exact location by clicking on the *Draw* button located under the map. Drawing the Plot is very simple. The User needs to place the mouse cursor at the desired place and to click on the left mouse button. When the shape of the Plot is satisfactory the User just needs to double click on the left mouse button. In the *Modify mode* the User can change the shape of the Plot by clicking on desired point and dragging it to the correct place. If any of points is unnecessary the User can simply delete it by placing mouse cursor over that point and clicking the Delete button on the keyboard. If the User selects and drags the light colored point, then a new one will appear in the middle of the line, between the light colored point and its neighbors and light colored point will become darker. When the User is satisfied with the shape and the position of the Plot he/she just needs to press the *Done* button or the *Reset* button if he/she is completely unsatisfied.

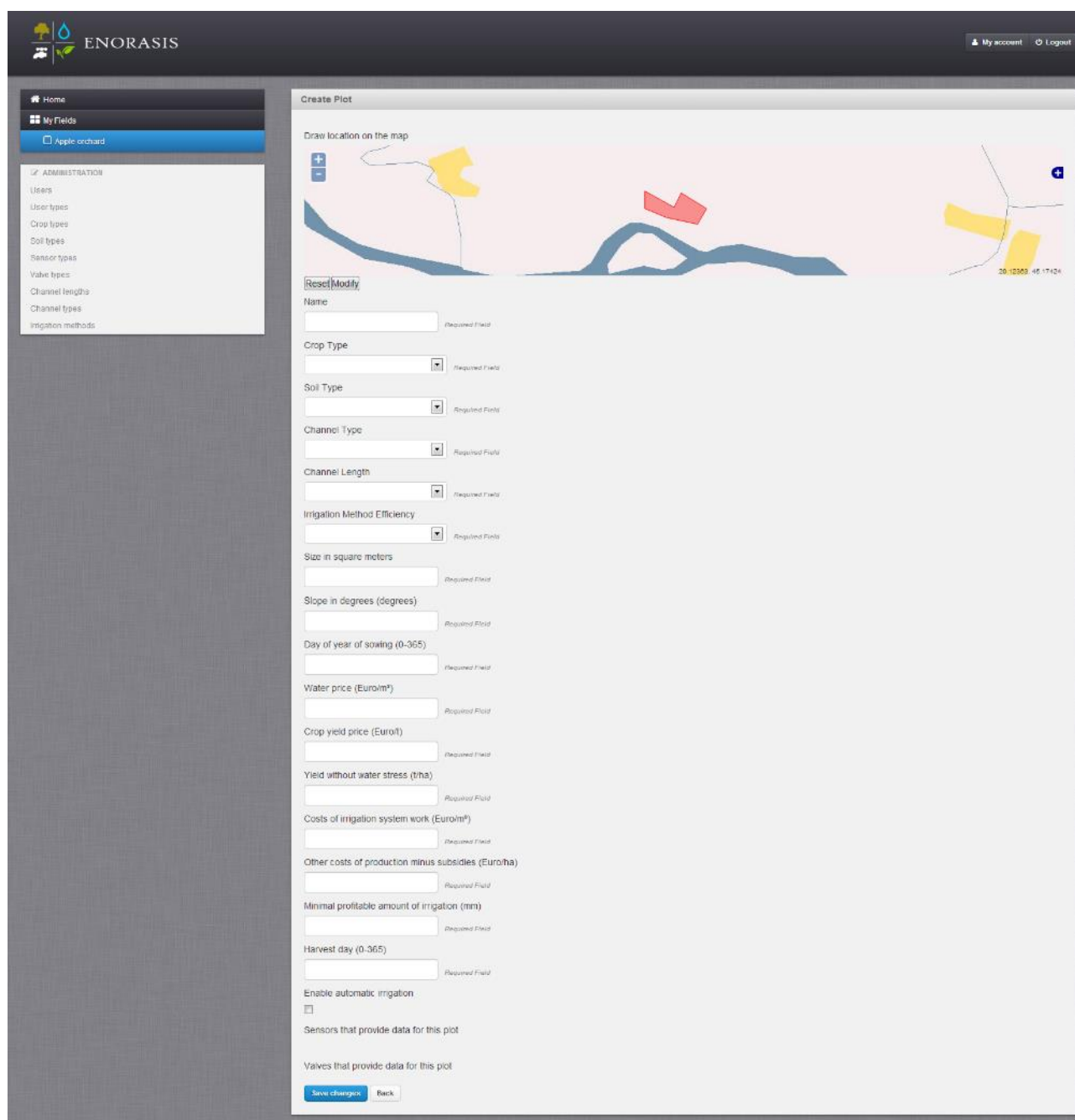
The required fields are:

- Name
- Crop Type – *drop list*
- Soil Type – *drop list*
- Channel Type – *drop list*
- Channel Length – *drop list*
- Irrigation Method Efficiency – *drop list*
- Size in square meters
- Slope in degrees (degrees)
- Day of year of sowing (0-365)
- Water price (Euro/m³)
- Crop yield price (Euro/t)
- Yield without water stress (t/ha)
- Costs of irrigation system work (Euro/m³)
- Other costs of production minus subsidies (Euro/ha)
- Minimal profitable amount of irrigation (mm)
- Harvest day (0-365)

Mandatory field is: Enable automatic irrigation.

The new Plot will be shown in the *Related Plots* grid as shown in Figure 37. The User has option to change the shape of the Plot or any value from the fields listed above by clicking on the *Edit* button in the *Related Plots* grid. The User has also the ability to delete the Plot by clicking on the *Delete* button as

shown in Figure 37. If the User has decided to delete the Plot he/she needs to confirm his/her decision by pressing the *Delete record* button – Figure 38.



Create Plot

Draw location on the map

[Resect/Modify](#)

Name Required Field

Crop Type Required Field

Soil Type Required Field

Channel Type Required Field

Channel Length Required Field

Irrigation Method Efficiency Required Field

Size in square meters Required Field

Slope in degrees (degrees) Required Field

Day of year of sowing (0-365) Required Field

Water price (Euro/m³) Required Field

Crop yield price (Euro/t) Required Field

Yield without water stress (t/ha) Required Field

Costs of irrigation system work (Euro/m³) Required Field

Other costs of production minus subsidies (Euro/ha) Required Field

Minimal profitable amount of irrigation (mm) Required Field

Harvest day (0-365) Required Field

Enable automatic irrigation ☐

Sensors that provide data for this plot

Valves that provide data for this plot

[Save changes](#) [Back](#)

Figure 36 – Create plot

Related Plots					+ Create
Name	Irrigation	Sensors	Valves	Actions	
Jonathan Gold		Sensors	Valves	Edit Delete	

Figure 37 – Updated Related Plots

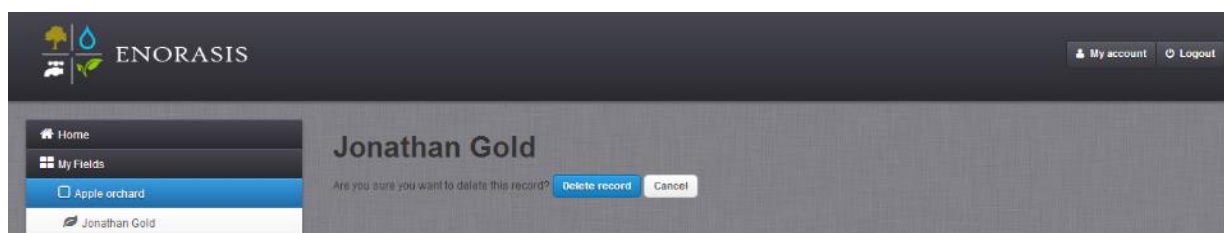


Figure 38 - Delete Plot

2.12 Plot View

Home

My Fields

Apple orchard

Cyprus

Poland-Crabow

Serbia

AG1

C1

Turkey

ADMINISTRATION

Users

User types

Crop types

Soil types

Sensor types

Valve types

Channel lengths

Channel types

Irrigation methods


C1

Edit

End Season

Start Season

Delete



Name: C1
Cost of work: 0.1
Crop type: Sweet Cherry (Serbia)
Crop yield price: 851
Minimal profitable amount of irrigation: -1
Other costs: 0.1
Date of sowing: 15
Size: 100
Slope: 0
Soil type: CLAY LOAM
Water price: 0.1
Yield without water stress: 3.3
Automatic irrigation enabled:
Harvest day: 0

Dss Results

View DSS Details

Liters to be watered today

0

Actions

OFF

Weather Forecast

Hide

Export wrf data

INSDATE	DATE	SOURCE	PPT_PRB	PPT_AMT	WND_SPD	SLR_RAD	MIN_TMP	MAX_TMP	REL_HUM
2013-09-08	2013-09-10	1	100	4.6	1.91	20.82	17.62	27.62	61.86
2013-09-08	2013-09-10	3	100	8.15	2.98	18.71	18.08	28.76	61.88
2013-09-08	2013-09-09	1	0	0.01	2.5	22.38	10.74	27.38	49.86
2013-09-08	2013-09-09	3	0	0.02	2.53	21.99	11.07	27.27	49.66
2013-09-07	2013-09-09	-1	0	0	1.87	21.64	10.81	26.52	64.43
2013-09-07	2013-09-09	-3	0	0	1.92	22.33	11.22	26.83	63.67
2013-09-08	2013-09-08	1	0	0	1.4	22.91	9.69	26.1	47.73
2013-09-07	2013-09-08	-3	0	0	1.54	22.69	9.31	24.88	52.89
2013-09-05	2013-09-08	-1	0	0	1.58	22.52	7.49	24.85	57.78
2013-09-05	2013-09-08	-2	0	0	1.34	22.53	7.4	25.13	52.05
2013-09-06	2013-09-08	-3	0	0	1.57	22.48	8.13	24.92	57.44
2013-09-07	2013-09-08	-1	0	0	1.61	22.7	9.53	24.87	52.5
2013-09-08	2013-09-08	3	0	0	1.29	22.91	9.74	25.96	48.21

Related Sensors

View Sensor Data

Create

Name	Type	Last reading	Actions
FTS_1_AH1	Relative Humidity Sensor [%]	08/09/2013 09:11:28	Add measurements Edit Delete
FTS_1_AT1	Temperature sensor [C]	08/09/2013 09:11:28	Add measurements Edit Delete
FTS_1_PP1	Rain Sensor with self emptying bucket [mm]	08/09/2013 09:11:28	Add measurements Edit Delete
FTS_1_WD1	Wind direction sensor - non DSS [deg]	08/09/2013 09:11:28	Add measurements Edit Delete
FTS_1_WS1	Wind speed sensor [Kmh] - non DSS	08/09/2013 09:11:28	Add measurements Edit Delete
FTS_3_SM1	Soil moisture sensor [%]	08/09/2013 18:11:16	Add measurements Edit Delete
FTS_3_SM2	Soil moisture sensor [%]	08/09/2013 18:11:17	Add measurements Edit Delete

Related Valves

Create

Name	Type	Actions
Test Serbia 2	Standard	Add water irrigation amount Edit Delete

Figure 39 – Plot View

In order to view the specific Plot, the User needs to click on the *My Fields* in the menu, to select an appropriate Field and then to click on the Plot. Web application will show five grids: Map of the Plot, DSS Results, Weather Forecast, Related Sensors and Related Valves as shown in Figure 39.

The Map of the Plot shows all details about the Plot. The User has four buttons: *Edit* for editing the shape and the details, *End Season* to indicate that season is over, *Start Season* to indicate that season has just begun and the *Delete* button to delete the selected Plot.

DSS Results shows the results of the Decision Support System for current day. Clicking the *View DSS Details* button will open page like the one shown in Figure 40. The User can go back by clicking on *Show plot details* button in upper right corner, or to expand grids by clicking on the *Show* buttons.

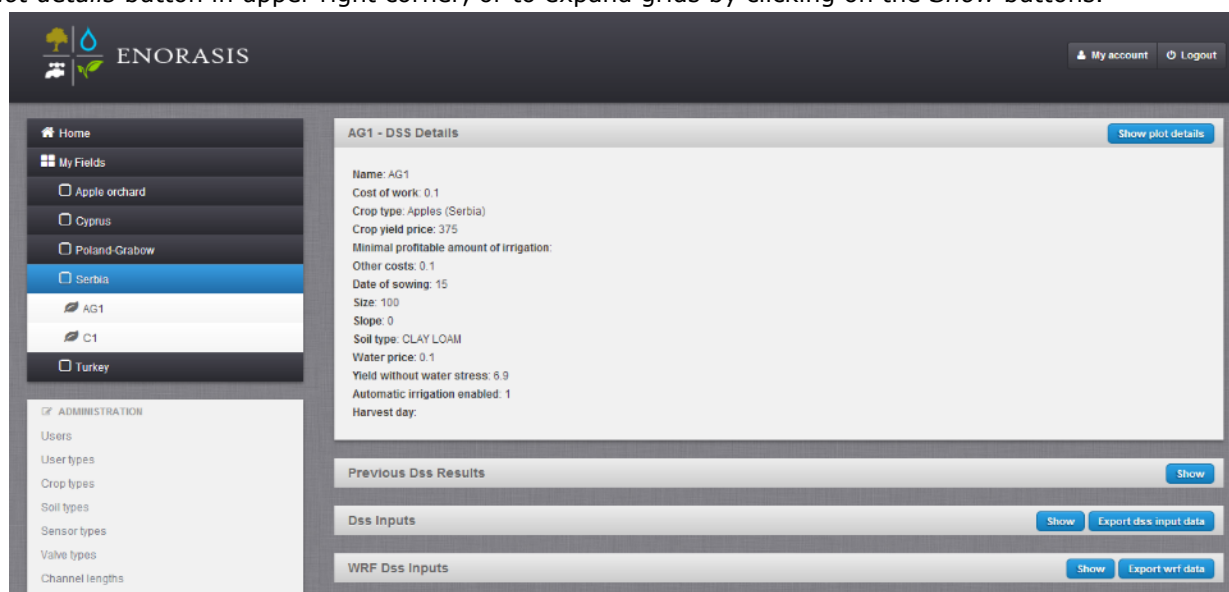


Figure 40 - View DSS Details

The expanded grids will be similar to those shown in Figure 41, Figure 42 and Figure 43.

Previous DSS Results		Hide
Datetime	Liters to be watered	
2013-09-08 05:52:25	0	
2013-09-07 05:51:51	0	
2013-09-06 05:53:42	0	
2013-09-05 11:41:41	0	
2013-09-02 05:58:35	0	
2013-09-01 05:51:23	0	
2013-08-31 05:51:42	0	
2013-08-30 05:53:07	0	
2013-08-29 05:51:39	0	
2013-08-28 05:51:14	0	
2013-08-27 05:52:47	0	
2013-08-26 05:53:40	0	
2013-08-25 05:51:31	0	
2013-08-24 05:51:25	0	
2013-08-23 05:50:42	0	
2013-08-22 05:52:49	0	

Figure 41 - Previous DSS Results

The *Previous DSS Results* grid shows the DSS results for a previous period. The *DSS Input* grid shows the inputs for the DSS system coming from sensor measurements deployed from in the fields and the *WRF DSS Inputs* show the inputs for the DSS system coming from the weather forecast. The input data can be exported by clicking on *Export DSS input data* or *Export WRF data* buttons.

Dss Inputs							Hide	Export dss input data
Date	P	Tmin (oC)	Tmax (oC)	RH	RS (MJ)	u		
2013-09-09	0	11.67	11.67	74				
2013-09-08	0	6.67	13.89	90.571428				
2013-09-07								
2013-09-06	0.2	0	9.44	94.333333				
2013-09-05	0	0	13.33	93.857142				
2013-09-04	0	0	0	95.5				
2013-09-03	0	0	0	90				
2013-09-02								
2013-09-01	0	12.22	13.33	90.75				
2013-08-31	2.2	0	13.89	96				
2013-08-30	1.6	12.22	20	93.5				
2013-08-29	1.6	14.44	20	94.25				
2013-08-28	7	16.11	17.22	96.3				
2013-08-27	0.2	14.44	16.11	82.714285				
2013-08-26	1.6	15.55	17.22	96.90909				
2013-08-25	34.2	13.33	19.44	95.0625				

Figure 42 - DSS Inputs

WRF Dss Inputs										Hide	Export wrf data
INSDATE	DATE	SOURCE	PPT_PRB	PPT_AMT	WIND_SPD	SLR_RAD	MIN_TMP	MAX_TMP	REL_HUM		
2013-09-09	2013-09-11	3	100	11.48	2.22	12.99	14.83	25.37	79.88		
2013-09-09	2013-09-11	2	100	17.91	2.21	9.62	17.5	22.9	81		
2013-09-09	2013-09-11	1	100	13.87	1.96	14.81	15.83	25.35	81.54		
2013-09-09	2013-09-10	1	94	5.75	1.9	16.91	13.96	28.17	75.95		
2013-09-09	2013-09-10	3	60	1.42	2.05	21.58	13.97	28.47	72.04		
2013-09-09	2013-09-10	2	44	0.02	2.38	21.42	16.08	29.61	60.62		
2013-09-08	2013-09-10	-1	100	4.6	1.91	20.82	17.62	27.62	61.86		
2013-09-08	2013-09-10	-3	100	8.15	2.88	18.71	18.08	28.76	61.88		
2013-09-09	2013-09-09	1	66	0.57	1.55	5.91	12.16	25.31	59.89		
2013-09-07	2013-09-09	-3	0	0	1.92	22.33	11.22	26.83	63.67		
2013-09-08	2013-09-09	-1	0	0.01	2.5	22.38	10.74	27.38	49.86		
2013-09-07	2013-09-09	-1	0	0	1.87	21.64	10.81	26.52	64.43		
2013-09-09	2013-09-09	2	0	0	2.36	14.45	15.4	27.02	45.67		
2013-09-09	2013-09-09	3	19	0.41	1.5	6.26	12.3	24.77	60.6		
2013-09-08	2013-09-09	-3	0	0.02	2.53	21.99	11.07	27.27	49.86		
2013-09-05	2013-09-08	-1	0	0	1.58	22.52	7.49	24.85	57.78		
2013-09-07	2013-09-08	-1	0	0	1.61	22.7	9.53	24.87	52.5		
2013-09-07	2013-09-08	-3	0	0	1.54	22.69	9.31	24.88	52.89		

Figure 43 - WRF DSS Inputs

2.13 Insert/Update Valves

The User firstly needs to select a desired Field and belonging Plot. The *Related Valves* grid is located at the bottom of the page - Figure 44.

Related Valves			+ Create
Name	Type	Actions	

Figure 44 – Related Valves

After clicking on the *Create* button the *Create Valves* form will be open as it shown in Figure 45. The required fields are:

- Name
- Valve type – *drop list*
- Serial number
- API key
- Water flow
- Diameter

The mandatory boxes are:

- Is remotely handled
- Takes water measurements
- Plots to which this valve provides data

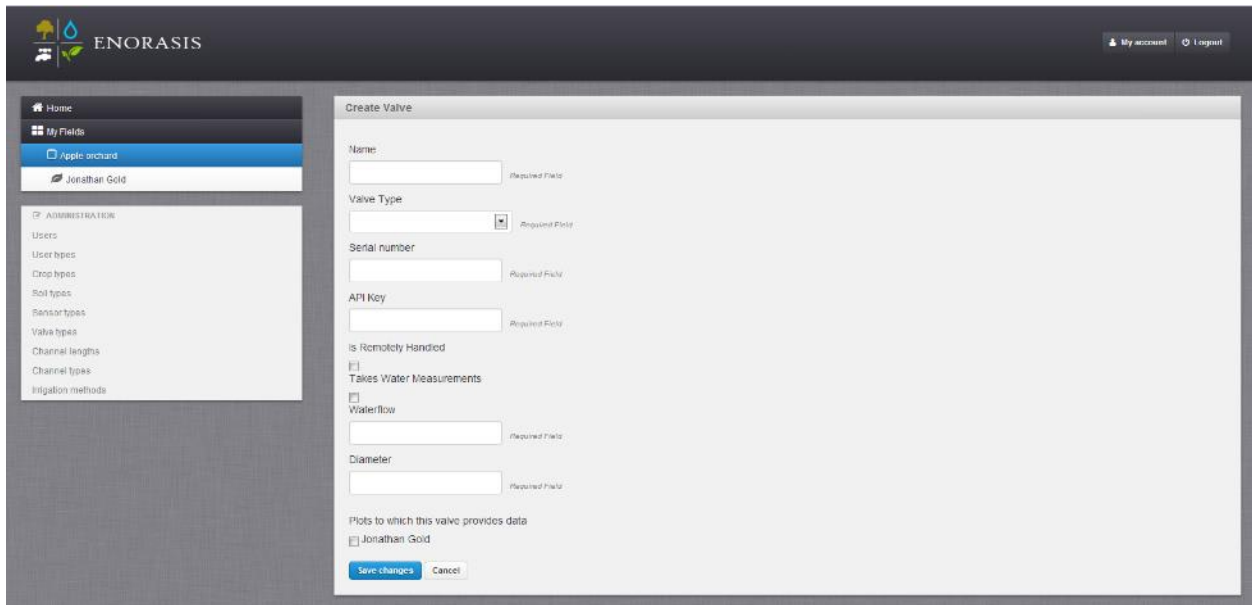


Figure 45 – Create Valve

After filling all the fields and saving the changes, then a new valve will be listed in the *Related Valves* grid.

Related Valves			+ Create
Name	Type		Actions
Mum apple valve			Edit Delete

Figure 46 – Updated Related Valves

2.14 Valve view

The User firstly needs to select a desired Field and belonging Plot. The *Related Valves* grid is located at the bottom of the page – Figure 47 - Related Valves

ENORASIS					My account	Logout
<div> <div>FTS_3_SM1</div> <div>Soil moisture sensor [%]</div> <div>2013-09-10 17:58:37</div> <div> Edit Delete </div> </div> <div> <div>FTS_3_SM2</div> <div>Soil moisture sensor [%]</div> <div>2013-09-10 17:58:38</div> <div> Edit Delete </div> </div>						
Related Valves				+ Create		
Name	Type			Actions		
Test Serbia 2	Standard			Edit Delete		
Test Serbia valve	Standard			Edit Delete		
Field Permissions						
<input type="text"/> <input type="text"/> <input type="button" value="Assign"/>						
Name	Email	Role	Approved	Actions		
Dotsoft	info@dotsoft.gr	READ ONLY	Yes	Delete		
Imaxdi	info@imaxdi.com	OWNER	Yes	Delete		
Enorasis	info@enorasis.eu	OWNER	Yes	Delete		

Figure 47 - Related Valves

To view the valve readings the User needs to click on its name. The Valve readings are listed as graph as well as table. The User can choose the date interval to display or to export as CSV file.

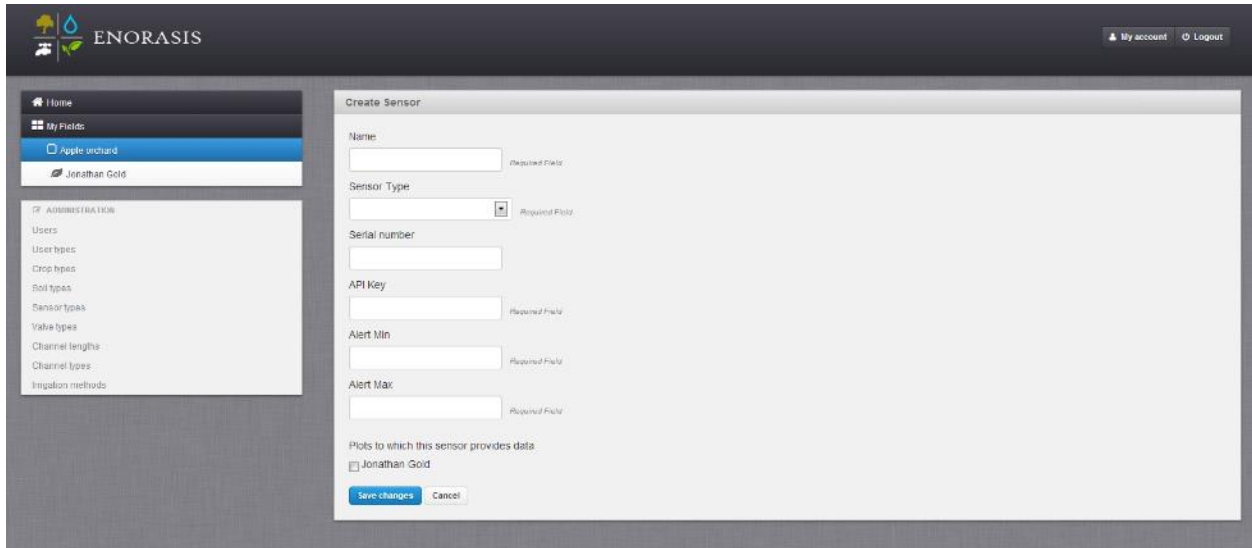
2.15 Insert/Update Sensors

The User firstly needs to select a desired Field and belonging Plot. The *Related Sensor* grid is located at the bottom of the page – Figure 48.

Related Sensors				+ Create
Name	Type	Last reading	Actions	

Figure 48 – Related Sensors

After clicking on the *Create* button the *Create Sensor* form will be open as it shown in Figure 49.



The 'Create Sensor' form is displayed within the ENORASIS interface. It includes a sidebar with navigation links like 'Home', 'My Fields', and 'Administration'. The main form area contains several input fields: 'Name' (Required Field), 'Sensor Type' (dropdown, Required Field), 'Serial number', 'API Key' (Required Field), 'Alert Min' (Required Field), and 'Alert Max' (Required Field). Below these fields is a section for 'Plots to which this sensor provides data' with a checkbox for 'Jonathan Gold'. At the bottom are 'Save changes' and 'Cancel' buttons.

Figure 49 – Create Sensor

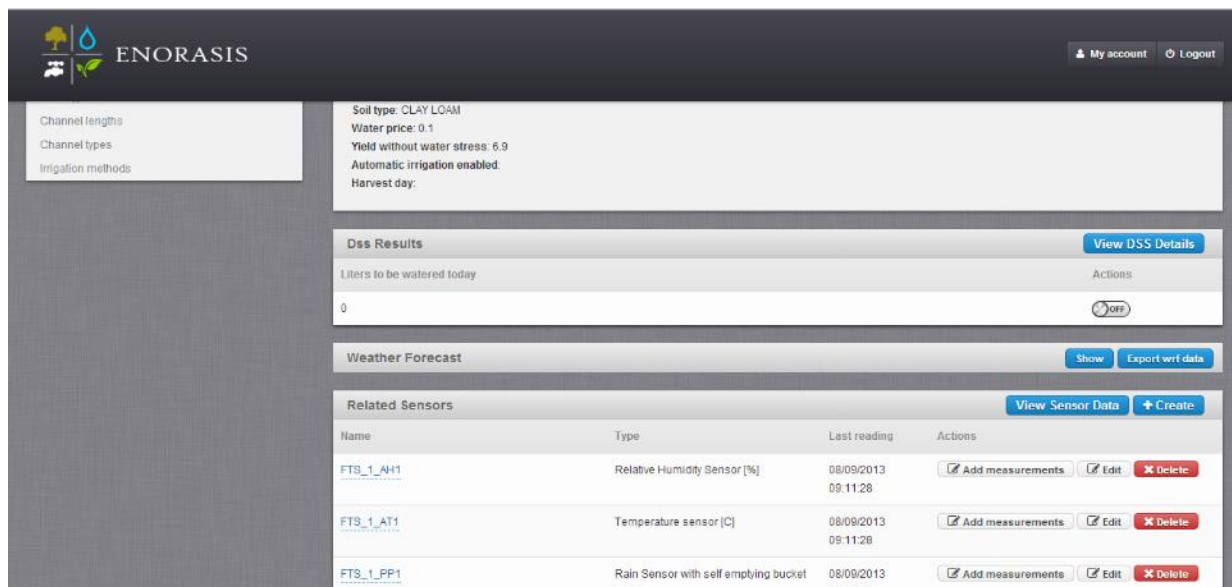
After filling in all the fields and saving the changes the new sensor will be listed in the *Related Sensors* grid - Figure 50.

Related Sensors				+ Create
Name	Type	Last reading	Actions	
AT	Temperature sensor [C]	Never	Edit	Delete

Figure 50 – Updated Related Sensors

2.16 Sensor view

The User firstly needs to select a desired Field and belonging Plot. The *Related Sensor* grid is located at the bottom of the page – Figure 51



The 'Sensor view' dashboard displays various information for a selected field. It includes a sidebar with navigation links like 'Channel lengths', 'Channel types', and 'Irrigation methods'. The main content area shows:

- Field details: Soil type: CLAY LOAM, Water price: 0.1, Yield without water stress: 6.9, Automatic irrigation enabled, Harvest day.
- DSS Results: Liters to be watered today (0), with a 'View DSS Details' button and an 'Off' toggle.
- Weather Forecast: With 'Show' and 'Export wrt data' buttons.
- Related Sensors grid: A table listing sensors with their names, types, last readings, and actions.

Name	Type	Last reading	Actions
FTS_1_AH1	Relative Humidity Sensor [%]	08/09/2013 09:11:28	Add measurements Edit Delete
FTS_1_AT1	Temperature sensor [C]	08/09/2013 09:11:28	Add measurements Edit Delete
FTS_1_PP1	Rain Sensor with self emptying bucket (mm)	08/09/2013 09:11:28	Add measurements Edit Delete

Figure 51 – Related Sensors

To view the sensor readings the User needs to click on its name. The Sensor readings are listed as graph as well as table. The User can choose the date interval to display or to export as CSV file - Figure 52 – Sensor data

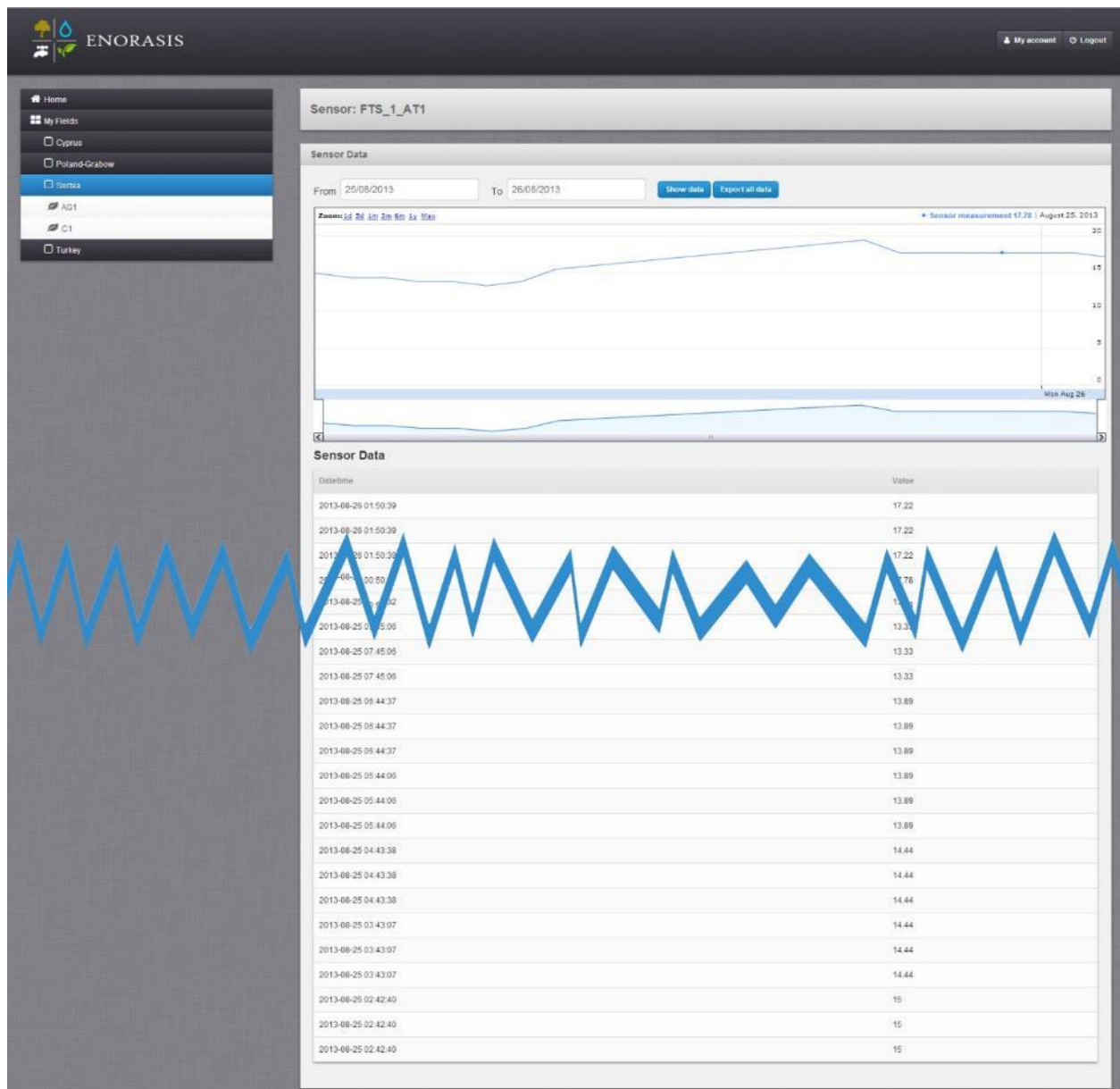


Figure 52 – Sensor data

2.17 Manually insert data for sensor

If for some reason the sensor readings cannot be sent automatically, the User can do that manually. The User firstly needs to select a desired Field and belonging Plot. The *Related Sensor* grid is located at the bottom of the page – Figure 53. In order to insert the data manually the User needs to click on the *Add measurements* button.

The User can enter the sensor readings manually on hourly base for that day as it is shown in Figure 54.

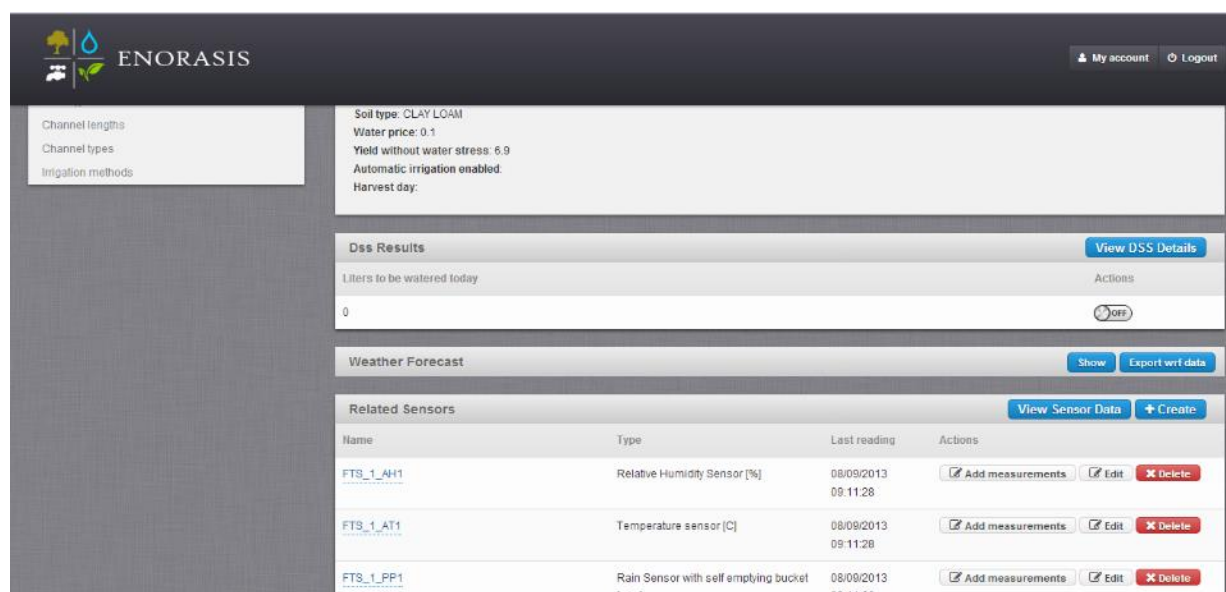


Figure 53 – Related Sensors

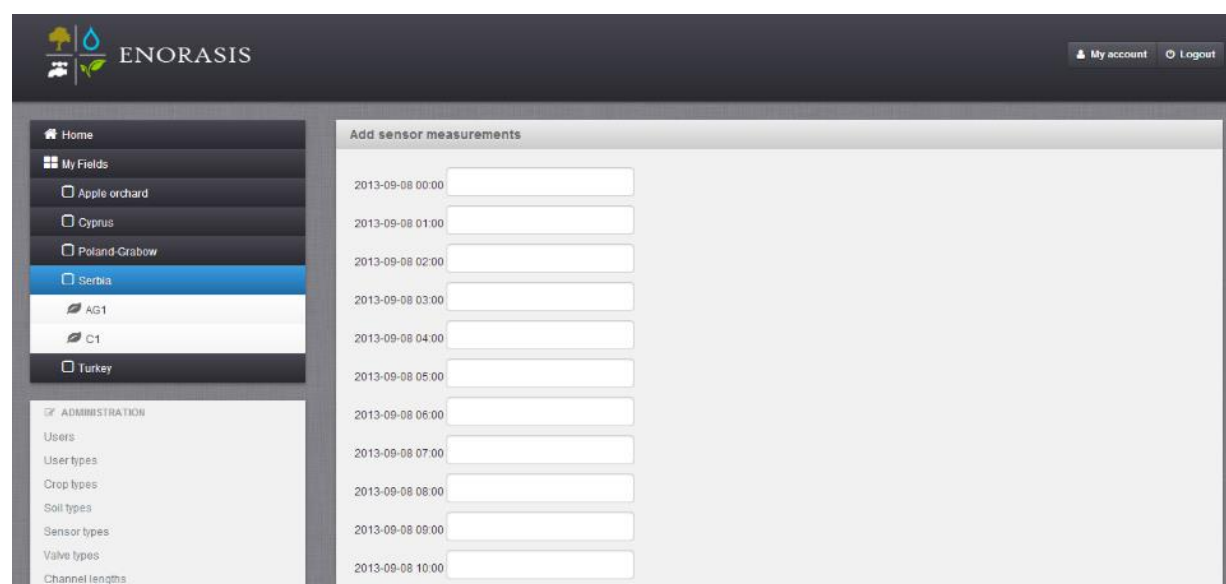
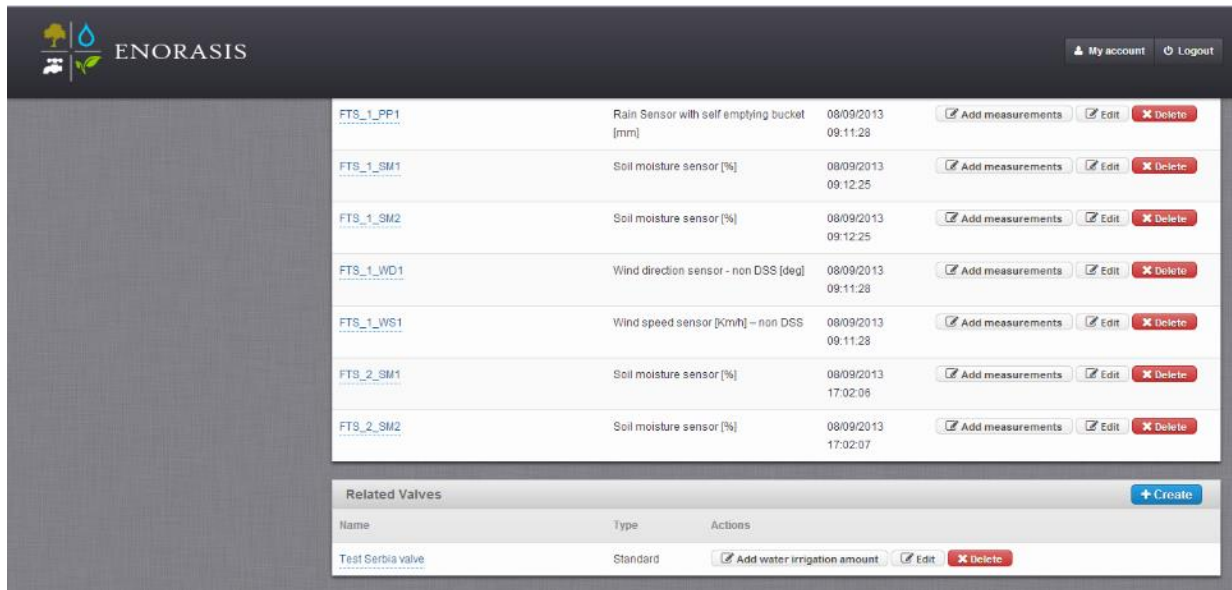


Figure 54 - Add sensor measurements

2.18 Manually insert data for valve

If the User has irrigated manually, he needs to fill the data for the water irrigation amount. The User firstly needs to select a desired Field and belonging Plot. The *Related Valves* grid is located at the bottom of the page – Figure 55. In order to insert the data manually the User needs to click on the *Add water irrigation amount* button.

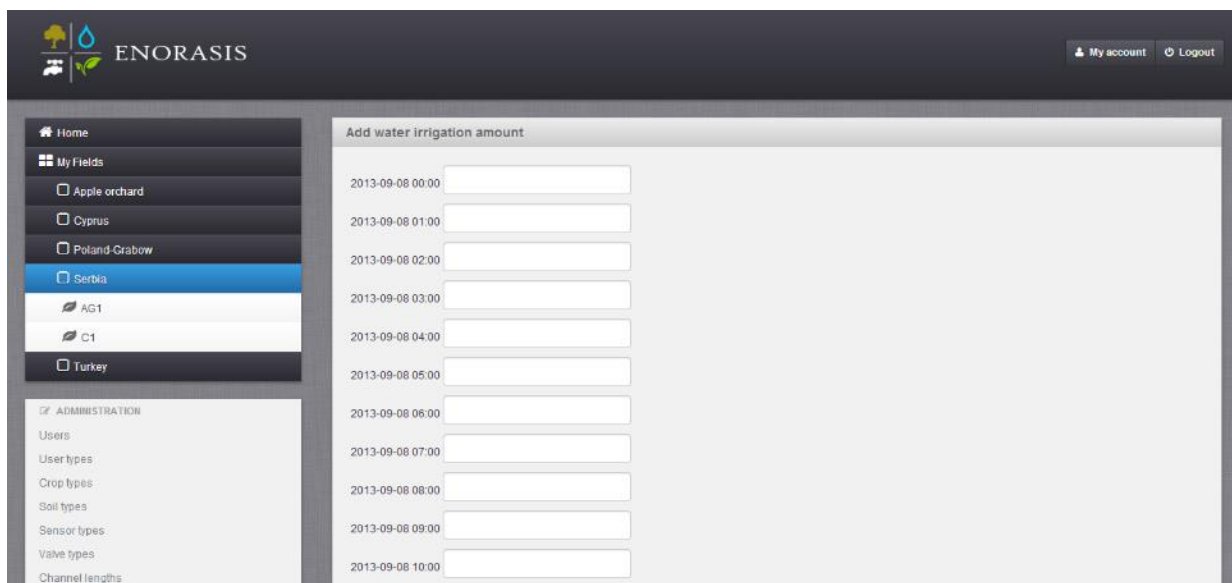
The User needs to enter the data on hourly base for that day as it is shown in Figure 56.



ENORASIS				My account Logout
FTS_1_PP1	Rain Sensor with self emptying bucket [mm]	08/09/2013 09:11:28	Add measurements Edit Delete	
FTS_1_SM1	Soil moisture sensor [%]	08/09/2013 09:12:25	Add measurements Edit Delete	
FTS_1_SM2	Soil moisture sensor [%]	08/09/2013 09:12:25	Add measurements Edit Delete	
FTS_1_WD1	Wind direction sensor - non DSS [deg]	08/09/2013 09:11:28	Add measurements Edit Delete	
FTS_1_WS1	Wind speed sensor [km/h] - non DSS	08/09/2013 09:11:28	Add measurements Edit Delete	
FTS_2_SM1	Soil moisture sensor [%]	08/09/2013 17:02:06	Add measurements Edit Delete	
FTS_2_SM2	Soil moisture sensor [%]	08/09/2013 17:02:07	Add measurements Edit Delete	

Related Valves			Create
Name	Type	Actions	
Test Serbia valve	Standard	Add water irrigation amount Edit Delete	

Figure 55 – Related Valves




ENORASIS		My account Logout																						
<ul style="list-style-type: none"> Home My Fields <ul style="list-style-type: none"> Apple orchard Cyprus Poland-Grabow Serbia AG1 C1 Turkey ADMINISTRATION <ul style="list-style-type: none"> Users User types Crop types Soil types Sensor types Valve types Channel lengths 	<h3>Add water irrigation amount</h3> <table border="1"> <tbody> <tr><td>2013-09-08 00:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 01:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 02:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 03:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 04:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 05:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 06:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 07:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 08:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 09:00</td><td><input type="text"/></td></tr> <tr><td>2013-09-08 10:00</td><td><input type="text"/></td></tr> </tbody> </table>	2013-09-08 00:00	<input type="text"/>	2013-09-08 01:00	<input type="text"/>	2013-09-08 02:00	<input type="text"/>	2013-09-08 03:00	<input type="text"/>	2013-09-08 04:00	<input type="text"/>	2013-09-08 05:00	<input type="text"/>	2013-09-08 06:00	<input type="text"/>	2013-09-08 07:00	<input type="text"/>	2013-09-08 08:00	<input type="text"/>	2013-09-08 09:00	<input type="text"/>	2013-09-08 10:00	<input type="text"/>	
2013-09-08 00:00	<input type="text"/>																							
2013-09-08 01:00	<input type="text"/>																							
2013-09-08 02:00	<input type="text"/>																							
2013-09-08 03:00	<input type="text"/>																							
2013-09-08 04:00	<input type="text"/>																							
2013-09-08 05:00	<input type="text"/>																							
2013-09-08 06:00	<input type="text"/>																							
2013-09-08 07:00	<input type="text"/>																							
2013-09-08 08:00	<input type="text"/>																							
2013-09-08 09:00	<input type="text"/>																							
2013-09-08 10:00	<input type="text"/>																							

Figure 56 – Add water irrigation amount

2.19 Assign rights to Users

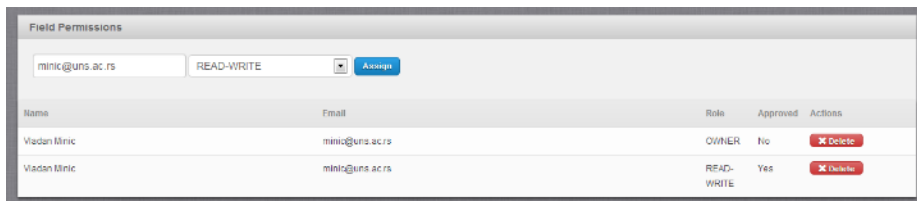
The User firstly needs to select a desired Field. The *Field Permissions* grid is located at the bottom of the page - Figure 57. On the *Field permissions* form the User needs to fill in the email of the person that he/she wants to give an access to the selected field. One of the predefined permission options needs to be selected from the drop down menu and finally the *Assign* button needs to be clicked.



Field Permissions				
<input type="text" value="minic@uns.ac.rs"/>		<input type="text" value="READ-WRITE"/>	Assign	
Name	Email	Role	Approved	Actions
Vladan Minic	minic@uns.ac.rs	OWNER	No	Delete

Figure 57 - Field Permissions

Granted User, its email and role will appear in the *Field Permissions* grid - Figure 58.



Name	Email	Role	Approved	Actions
Vladan Minic	minic@uns.ac.rs	OWNER	No	Delete
Vladan Minic	minic@uns.ac.rs	READ-WRITE	Yes	Delete

Figure 58 – Updated Field Permissions

3. MIDDLEWARE

3.1 Login Screen

Currently the system supports English and Turkish but has capability to support multiple languages.

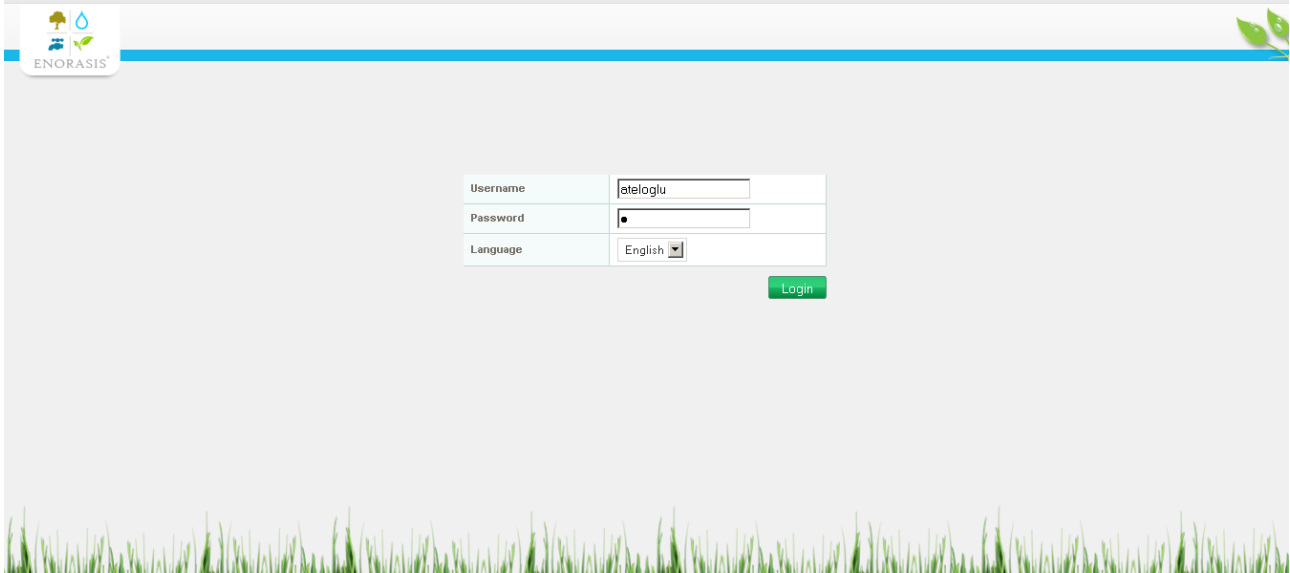


Figure 59 - Main Login Screen

3.2 Main Screen

The Main screen has a very simple and easy to use interface. The interface will only show the coordinators that the User has access to. It will also indicate which ones are online by highlighting the blue drop of water on the screen. If the coordinator is offline, this image will be faded to grey.

Click on one of the coordinators to see the devices and change settings of the coordinator.

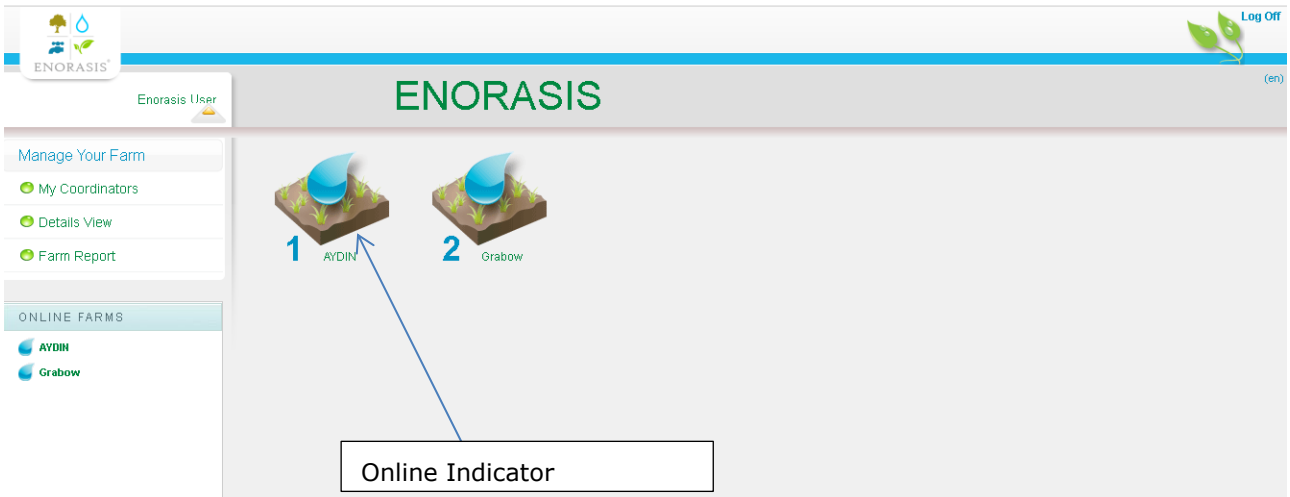


Figure 60 - Home Screen

3.3 Editing Coordinator Information (Details View)

This screen is used to update the Basic coordinator information such as Name, IEEE Address (not required), IMEI number of the GSM Modem, notes and other information.

Caution: IMEI number is critical, unless it's defined correctly, the system will not allow this device to connect to the server.

Edit Coordinator Info;

«Return to Coordinator List

EDIT COORDINATOR INFO	
Name	AYDIN
IEEE Address	
Ip Address	188.57.45.150
	5349656177
Imei Number	35923103285237652
Notes	
Inserted By	3/11/2013 11:33:30 PM/ateloglu
Updated By	9/18/2013 3:47:48 PM/service

[Save](#)

Be careful when editing this info, it might cause coordinator not to work properly.

Figure 61 - Edit coordinator Details Screen

3.4 Edit Coordinator

This screen enables the User to perform operations such as change mode, change time, scan the network, and purge all devices on the network, change settings and whitelist devices to enable them to join the network.

«Return to Coordinator List | Network View | Graph |

[Farm](#)
[Coordinator](#)

Name	AYDIN
	5349656177
Imei Number	35923103285237652
Ip Address	188.57.45.150
Current Mode	-Manual-Running-No?
Next Wake Up Time	3/11/2013 11:33:30 PM
Coordinator Time	9/17/2013 9:25:28 PM
Notes	

- Create Zone
- Scan
- Change Mode
- Change Time
- Get Time
- Purge All Devices
- Change Settings
- WL

Figure 62 - Edit Coordinator Screen

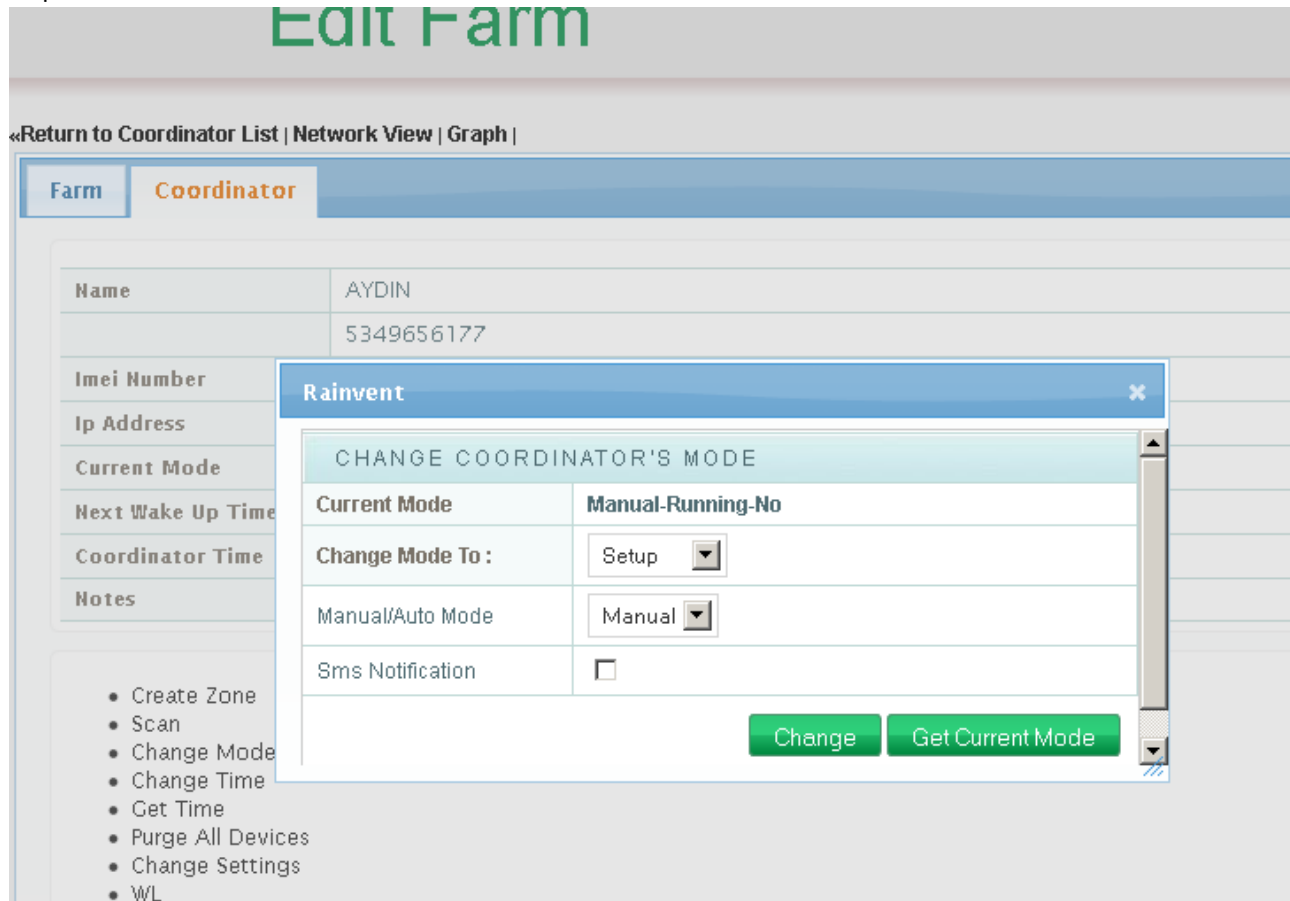
3.5 Changing Modes

The system has two modes.

- Running Mode: Where the system will start sending and recording logs.
- Commissioning mode: Which is used at initial system configuration/scanning and commissioning.

This Screen will allow the User to switch between these two modes. Once the mode change button is clicked, the system will ask the User to wait for an "ACK". This is basically an acknowledgement message from the system saying that the coordinator actually received the "changemode" request.

Unless an "ACK" is received, the User will get a "command failed message" and will have to repeat the request.



The screenshot shows the 'Edit Farm' interface. At the top, there's a title bar 'Edit Farm' and a navigation bar with 'Return to Coordinator List | Network View | Graph |'. Below this, there are tabs for 'Farm' and 'Coordinator'. The 'Coordinator' tab is active, showing details for a coordinator named 'AYDIN' with IMEI number '5349656177'. A modal dialog box titled 'Rainvent' is open, titled 'CHANGE COORDINATOR'S MODE'. It contains a table with the following data:

Current Mode	Manual-Running-No
Change Mode To :	Setup
Manual/Auto Mode	Manual
Sms Notification	<input type="checkbox"/>

At the bottom of the dialog, there are two buttons: 'Change' and 'Get Current Mode'. On the left side of the 'Edit Farm' screen, there is a sidebar with a list of actions: Create Zone, Scan, Change Mode, Change Time, Get Time, Purge All Devices, Change Settings, and WL.

Figure 63 - Change Mode Screen

3.6 WhiteListing Devices

Before performing a network Scan, all devices that will be connected to the coordinator will have to be WhiteListed. This function is required for the controlled configuration of the network, preventing other unwanted devices nearby from connecting to the network.

This screen allows the User to add new devices to the list of acceptable devices using their IEEE addresses which are printed on the back of the device enclosures.

Farm		Coordinator	
Name	AYDIN		
	5349656177		
Imei Number	35923103285237652		
Ip Address	188.57.45.150		
Current Mode	-Manual-Running-No?		
Next Wake Up Time	3/11/2013 11:33:30 P		
Coordinator Time	9/17/2013 9:25:28 PM		
Notes			

- Create Zone
- Scan
- Change Mode
- Change Time
- Get Time
- Purge All Devices
- Change Settings
- WL

Rainvent

Add

20B62800008D1500
1BB12100008D1500
1DB12100008D1500
3CB62800008D1500
1FB62800008D1500
23B62800008D1500
20B62800008D1500

Figure 64 – Whitelisting Devices

3.7 Scanning the Network

The Scan Network screen lists a series of devices, indicating their types and IEEE addresses. At the initial screen, the User will see this information in small boxes (one per device).

Scan Results

Sensor Box

(1) 4162
26B12100008D1500(
Sensor Box)
7/19/2013 5:24:57 AM

(2) 4162
20B62800008D1500(
Sensor Box)
9/18/2013 2:59:35 PM

(4) 4162
1BB12100008D1500(
Sensor Box)
8/16/2013 10:28:05 AM

(6) 4162
1CB62800008D1500(
Sensor Box)
9/18/2013 3:07:36 PM

(15) 4162
18B12100008D1500(
Sensor Box)
9/16/2013 11:39:21 PM

(16) 4162
3DB62800008D1500(
Sensor Box)
9/16/2013 11:36:27 PM

Actuators

(5) 4162
17B12100008D1500(
Valve)
7/16/2013 11:48:52 AM

(7) 0
1FB62800008D1500(
Valve)
7/14/2013 11:04:52 PM

(8) 18277
16B12100008D1500(
Valve)
7/16/2013 4:20:28 PM

(9) 4162
1DB12100008D1500(
Valve)
7/16/2013 4:27:46 PM

Figure 65 – Scanning Network

Version – issue date: 1.0 – 02/12/2013

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Upon a successful scan, the boxes of information will "Blossom" as in Figure 66, indicating that these devices actually responded to the scan request and are available for communication.

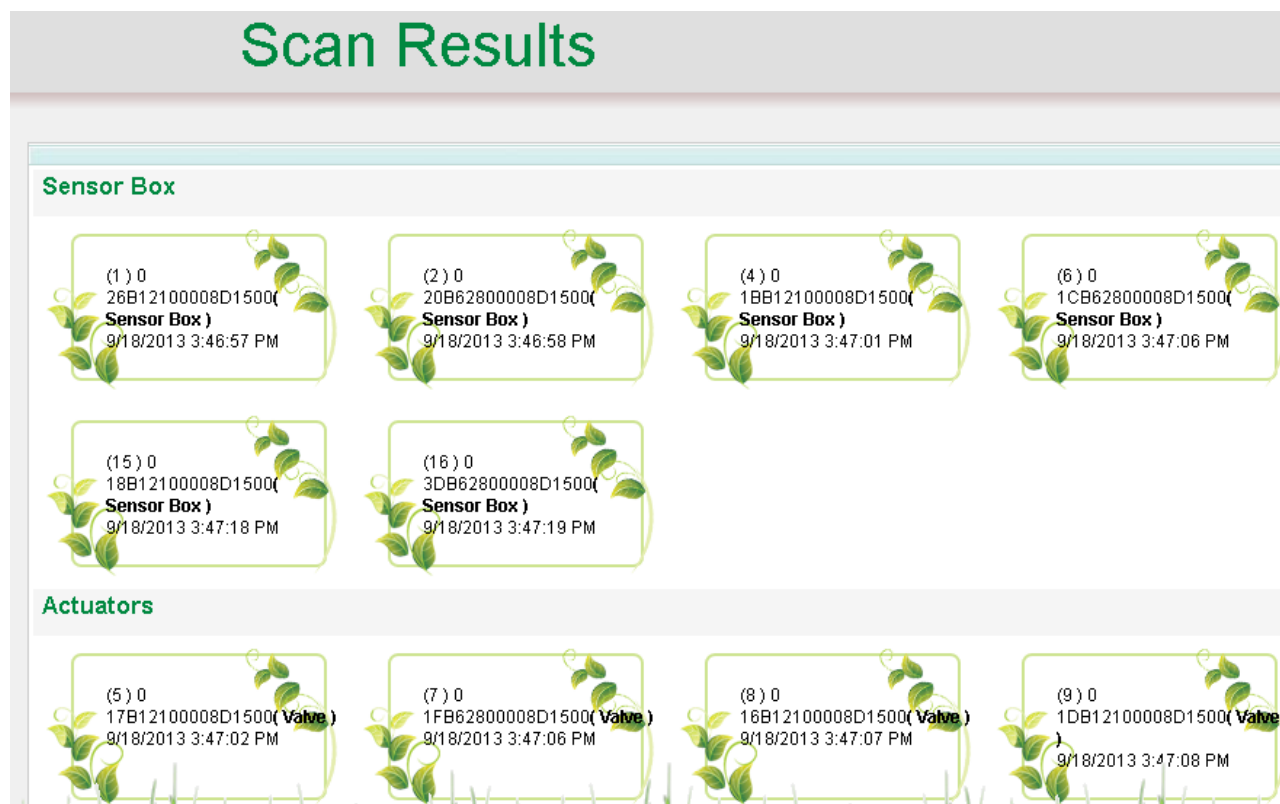


Figure 66 – Scan Results View

3.8 Network View

The Network View is a useful administration tool to view the communication details of the network. It will tell the User, the total number of packets received and the number that failed, as well as an overall percentage of dropped network packets.

Upon clicking on the Request Network Status button, the User will be asked for a confirmation. Once the User confirms, s/he will be required to wait for an "ACK". After the ACK is received, the User will have to click on the "Refresh" link to update the view with the new information.

Caution: This command returns heavy traffic, and the User may have to repeatedly request until an ack is received.

Network View

Zone View | Network View

NETWORK VIEW

18001042008D1500

Refresh

Request For Network Status

- 20B62800008D1500 - (269,12788,40299) ~(96) ~ **1%**
- 26B12100008D1500 - (838,46277,27090) ~(84) ~ **3%**
- 1CB62800008D1500 - (892,63820,5451) ~(93) ~ **16%**
- 3DB62800008D1500 - (894,60927,10009) ~(96) ~ **9%**
- 1BB12100008D1500 - (876,11088,43958) ~(102) ~ **2%**
- 18B12100008D1500 - (963,1599,39720) ~(105) ~ **2%**

Figure 67 – Network View

4. DSS BASED ON GIS TOOL (or GIS DASHBOARD TOOL)

The "DSS Based on GIS Tool" is an interactive WEB GIS application that allows Users to access spatial data related to the information for each land zone in the system, the information on the sensors, the irrigation knowledge base parameters derived from using FAO56 model and the meteorological forecasts in a map, in order to create the daily individual irrigation plan for each case.

User can access the "DSS Based on GIS Tool" by a web browser. The User Interface (UI) of the application is presented in the following image.

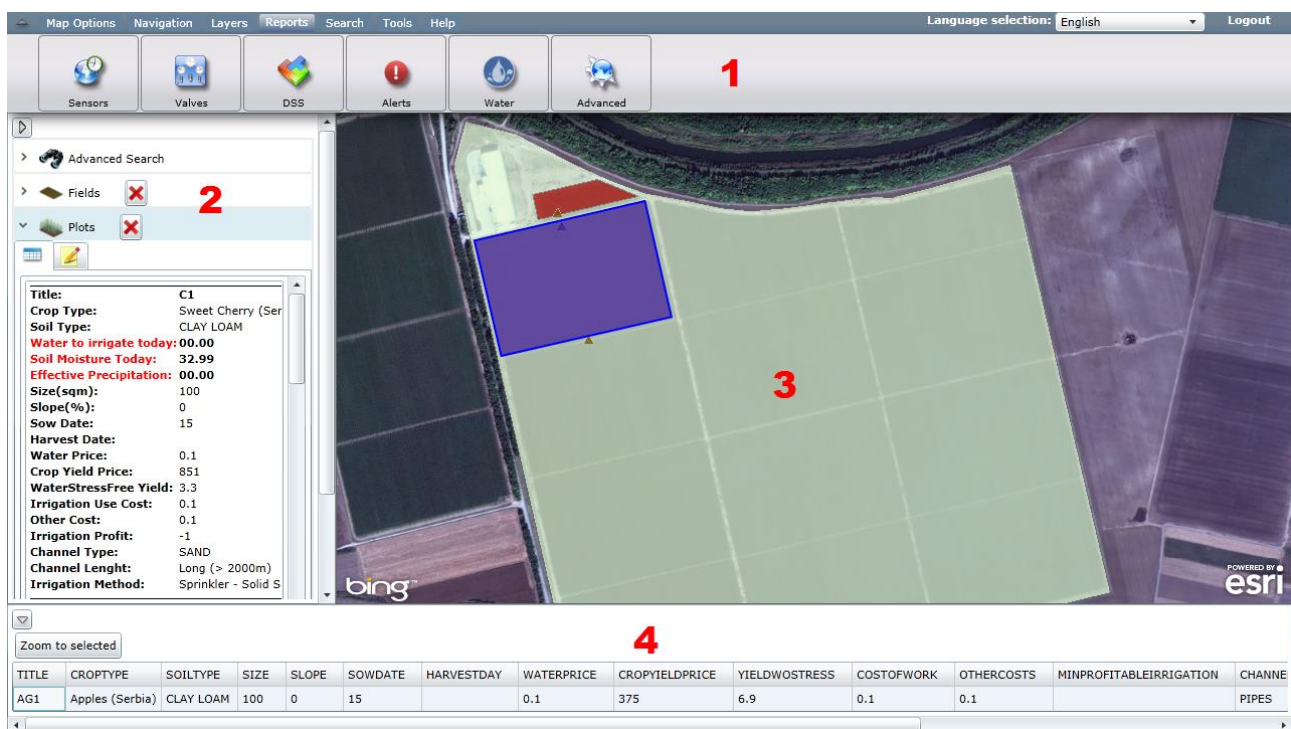


Figure 68 - User Interface

The UI is divided in four panels:

- Panel 1: Applicationmenus.

The following menus are available:

- MapOptions;
- Navigations;
- Layers;
- Reports;
- Search;
- Tools; and
- Help.

In each menu there are several tools which performs specific operations like map navigations, add a layer, reporting, etc.

- Panel2: Layers

The Layer panel displays information about the ENORASIS layers that are overlaid on the map. This includes the legend as well as other layer-related tools like zoom to feature extent, remove layer or change the layer transparency.

- Panel3: Map

The Map panel displays the interactive map. You can navigate through the map using the menu tools or the mouse. It can also interact with the map features using one of the available tools (for example, measuring tools, reporting tools or feature info tools presented below).

- **Panel 4: Grid Data View**

The Grid Data View provides a tabular display of the ENORASIS layer's data; graphics can be selected and zoomed to by interacting with the Feature Data Grid.

4.1 Login

In order to obtain full access to the "DSS Based on GIS Tool", the User has to login using his email and password provided by the administrator of the system. The data is filtered based on User credentials.

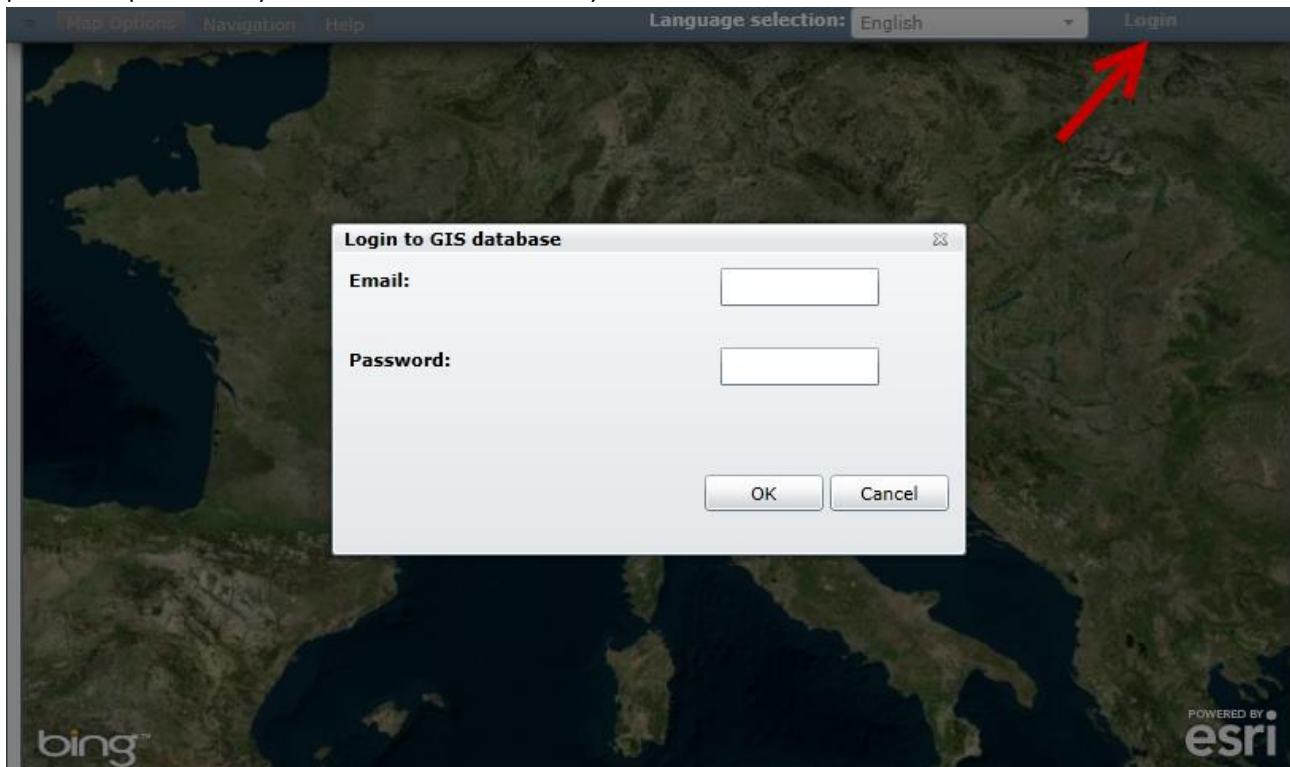


Figure 69 - Log in

4.2 Map Options

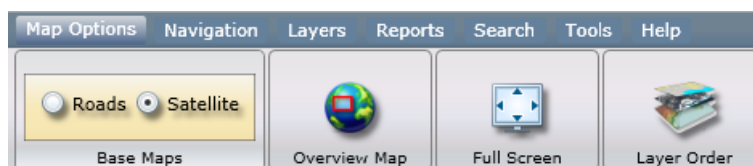
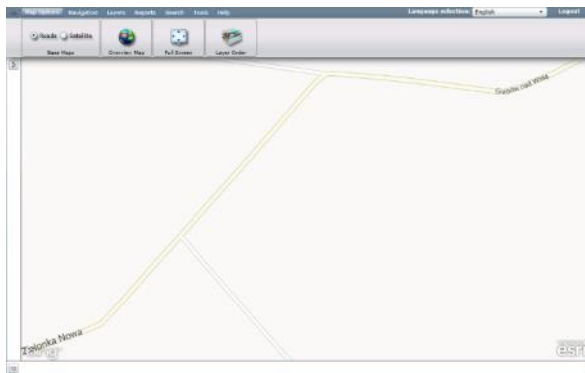
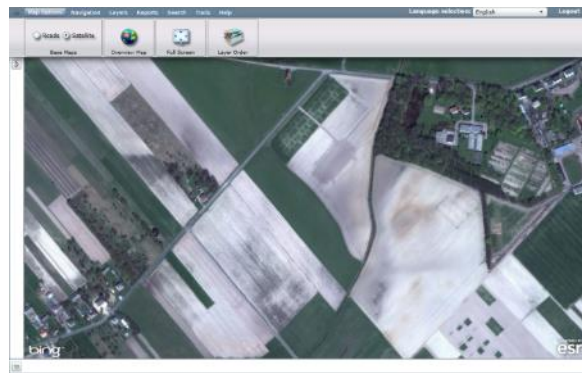


Figure 70 - Map Options Menu

- **Base Maps:** You can select the map that will be displayed as ENORASIS base map. User can choose between Roads and Satellite Bing Maps.



RoadBaseMap



SatelliteBaseMap

- Overview map: Display an overview map.



Figure 71 - Overview Map

- Full Screen: Run the application in Full Screen Mode.
- Layer Order: Provides an interface to change the order of the available ENORASIS layers on the map.

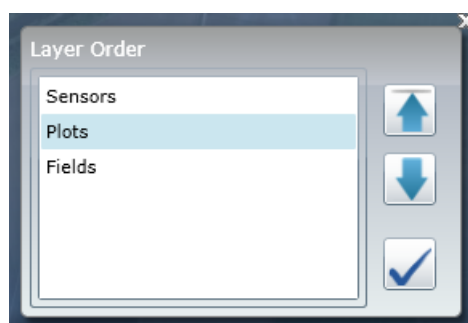


Figure 72 - Layer Order

4.3 Navigation

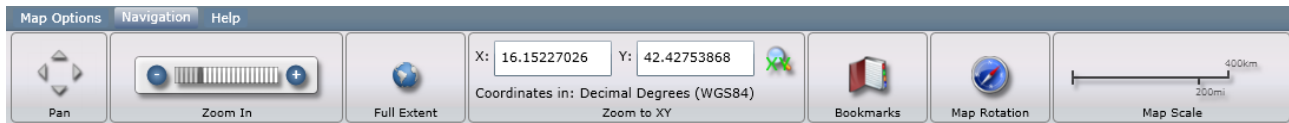


Figure 73 - Navigation Menu

- Pan: Move map Right, Left, Up, Down.
- Zoom in: Zoom in or out in the map.
- Full Extent: Change map extents to full extent.
- Zoom to XY: Display the coordinates of the map center. You can also enter coordinates in order to navigate to that location.
- Bookmarks: Bookmarks are predefined map extents of ENORASIS pilots. When you select one bookmark the map zooms to selected ENORASIS pilot extent.
- Map Rotation: Provide an interface in order to rotate the map.
- Map Scale: An interactive scale bar. The units are automatically updated each time the map changes.

4.4 Layers

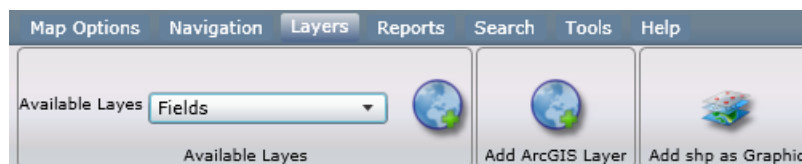


Figure 74 - Layers Menu

- Available Layers: Provide a list of ENORASIS related layers (Fields, Plots, Sensors, Weather Forecast Today, Weather Forecast Tomorrow and Weather Forecast Day After Tomorrow). You can select an ENORASIS layer in order to be overlaid in the map. The legend is also displayed in Panel 2. From Panel 2, User can remove the ENORASIS layer from the map, open the feature data grid, show the layer's legend, auto zoom to feature clicking on feature details, change the transparency of the layer using the slider in the ENORASIS layer name or toggle the visibility of the layer.

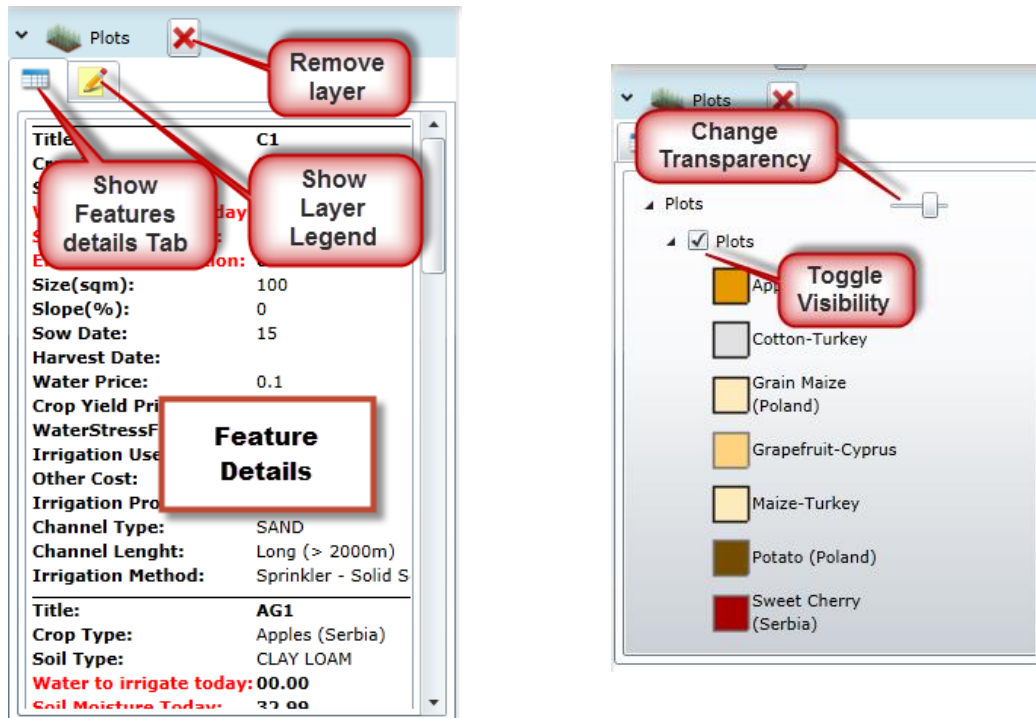


Figure 75 - Functionalities of Layer's legend

- Add ArcGIS Layer: You provide an ArcGIS REST url of a map Service. The map is updated with the requested map layer.

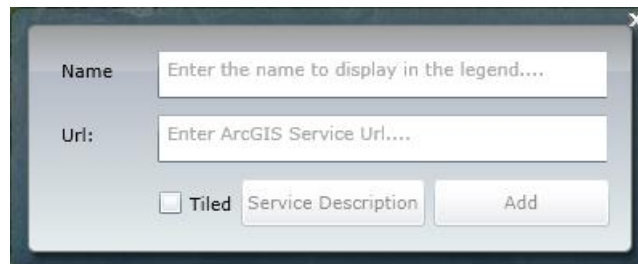


Figure 76 – ArcGIS Layer

- Add shp as Graphic: You can add a shapefile stored in your computer to the map viewer. You have to select a zipped file.

4.4.1 Add Enorasis Layer

In order to add an ENORASIS Layer, User has to select the desirable layer (Fields, Plots, Sensors, Weather Forecast Today, Weather Forecast Tomorrow or Weather Forecast Day After Tomorrow) from the drop list in Layers menu and then to click the "add layer button".

The ENORASIS layer is added on the map and its details (feature details and legend) are shown on panel 2.

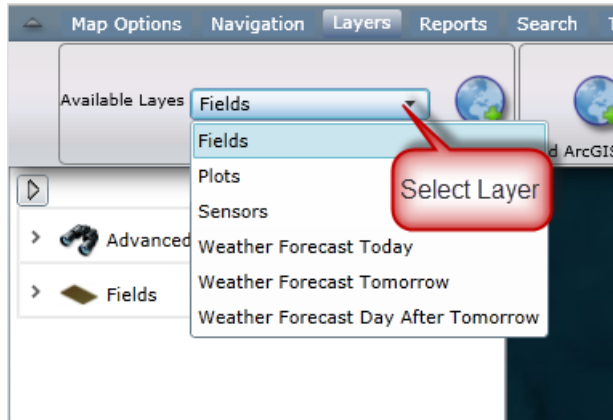


Figure 77 – Available Layers

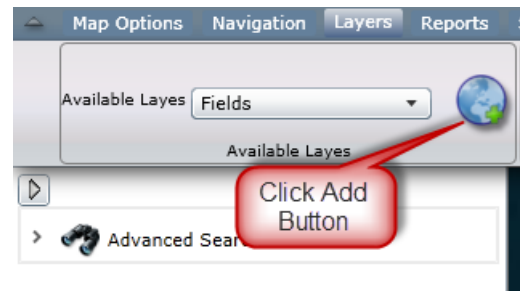


Figure 78 – Add Layer Button

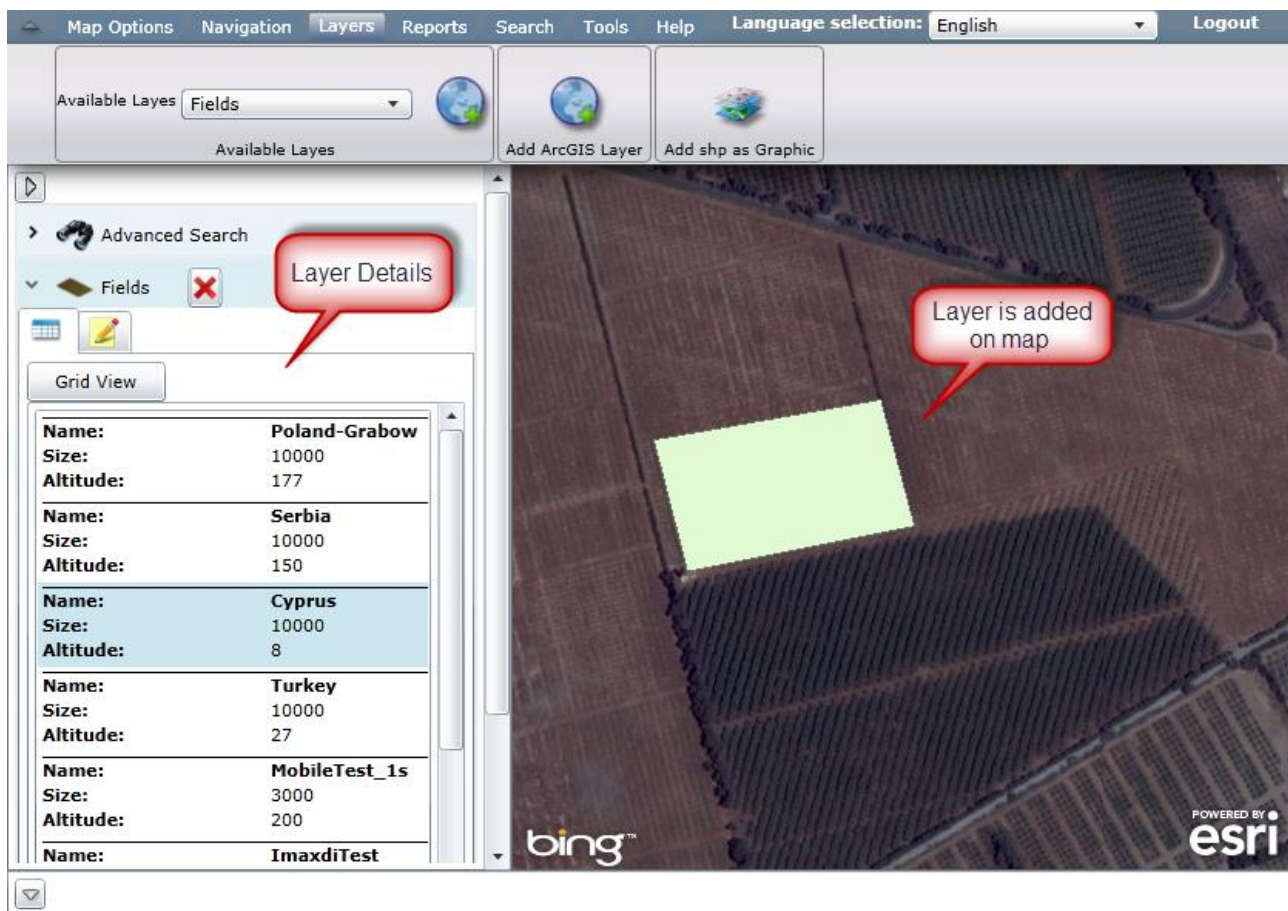


Figure 79 – Layer Details

4.4.2 View Enorasis Layer Details

After ENORASIS Layer is added, User can see details about it on panel 2 in table record format or on panel 4 in row format. Clicking on a feature on panel 2, the map zooms on it. Alternatively, User can select a record from tabular view and then click on "Zoom to Selected" button.

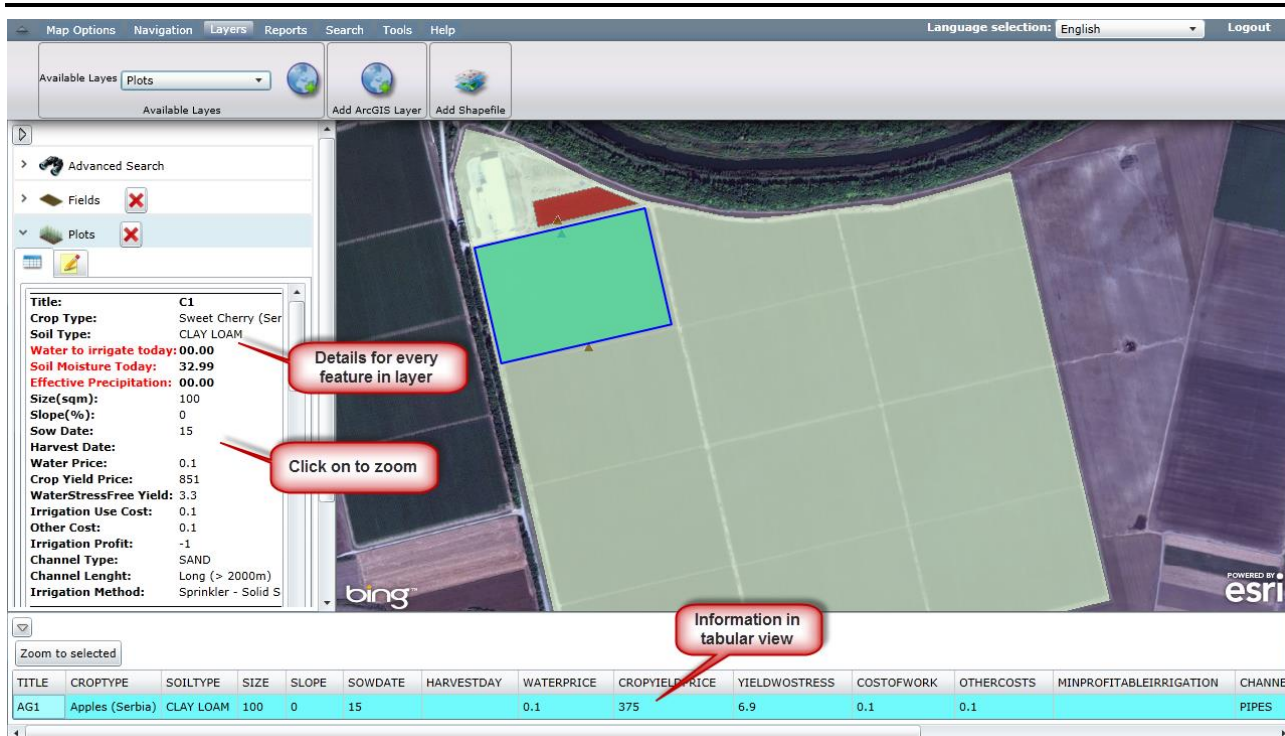


Figure 80 – Feature Layer Details

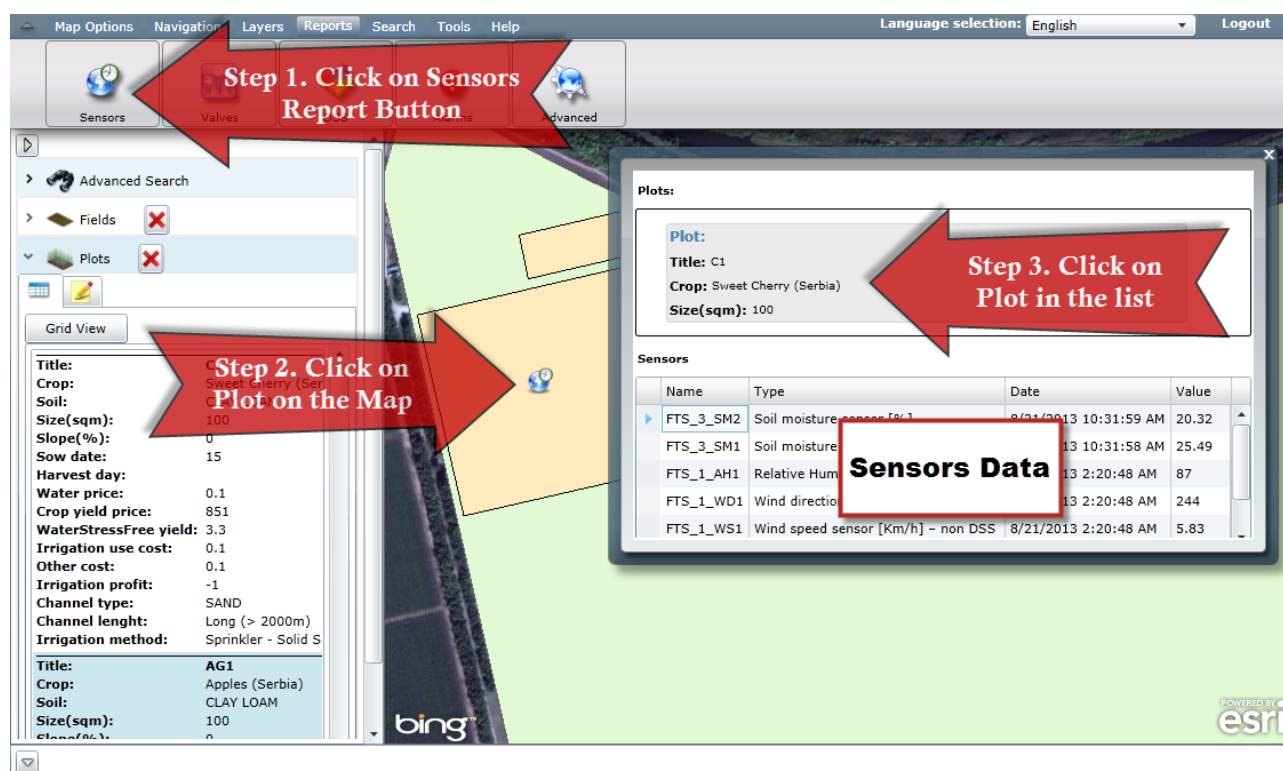
4.5 Reports

From Reports Menu User can get reports for Sensors and Valves data, DSS results, Alerts, Irrigation Water or sensor's history data.



Figure 81 – Reports Menu

4.5.1 View Sensors Report



Step 1. Click on Sensors Report Button

Step 2. Click on Plot on the Map

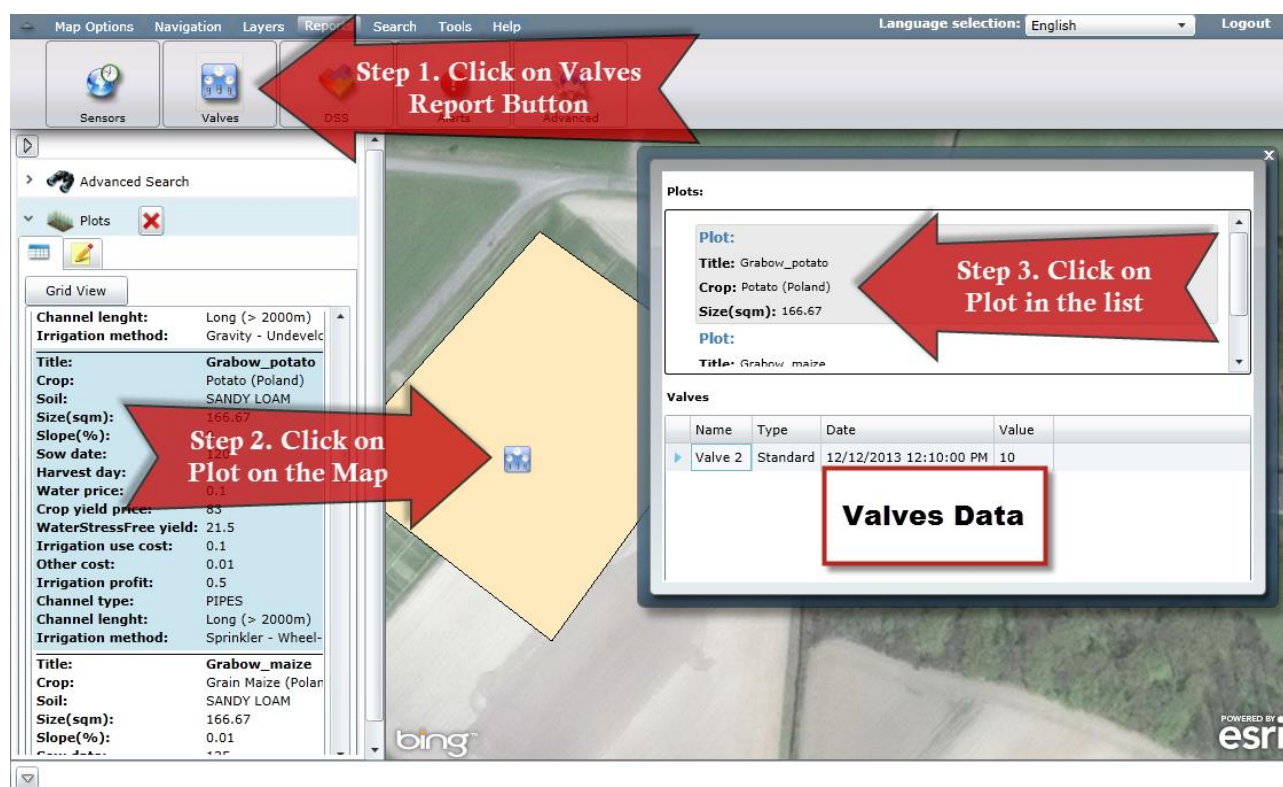
Step 3. Click on Plot in the list

Sensors Data

Name	Type	Date	Value
FTS_3_SM2	Soil moisture sensor [g/1	8/21/2013 10:31:59 AM	20.32
FTS_3_SM1	Soil moisture	8/21/2013 10:31:58 AM	25.49
FTS_1_AH1	Relative Hum	8/21/2013 2:20:48 AM	87
FTS_1_WD1	Wind direction	8/21/2013 2:20:48 AM	244
FTS_1_WS1	Wind speed sensor [Km/h] – non DSS	8/21/2013 2:20:48 AM	5.83

Figure 82 – Sensors Data Report

4.5.2 View Valves Report



Step 1. Click on Valves Report Button

Step 2. Click on Plot on the Map

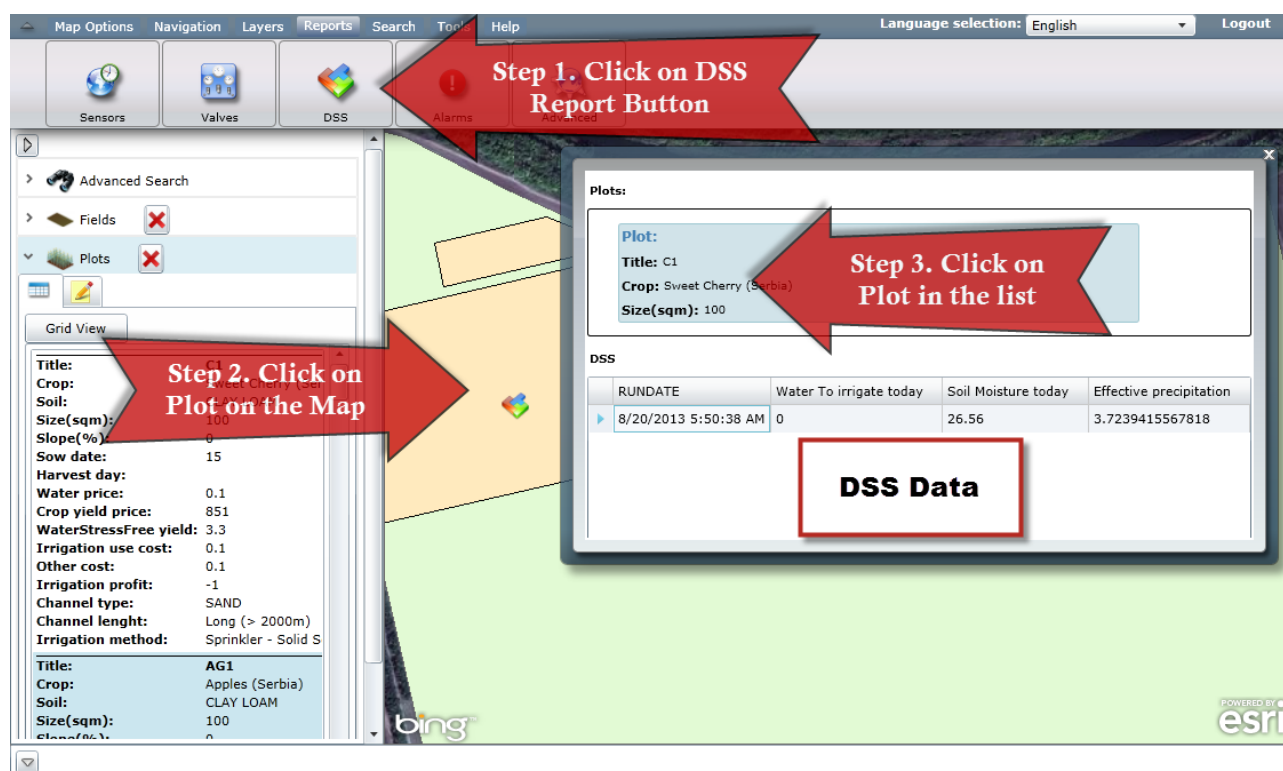
Step 3. Click on Plot in the list

Valves Data

Name	Type	Date	Value
Valve 2	Standard	12/12/2013 12:10:00 PM	10

Figure 83 – Valves Report

4.5.3 View DSS Report



Step 1. Click on DSS Report Button

Step 2. Click on Plot on the Map

Step 3. Click on Plot in the list

DSS Data

RUNDATE	Water To irrigate today	Soil Moisture today	Effective precipitation
8/20/2013 5:50:38 AM	0	26.56	3.7239415567818

Figure 84 – DSS Report

4.5.4 View Alerts Report

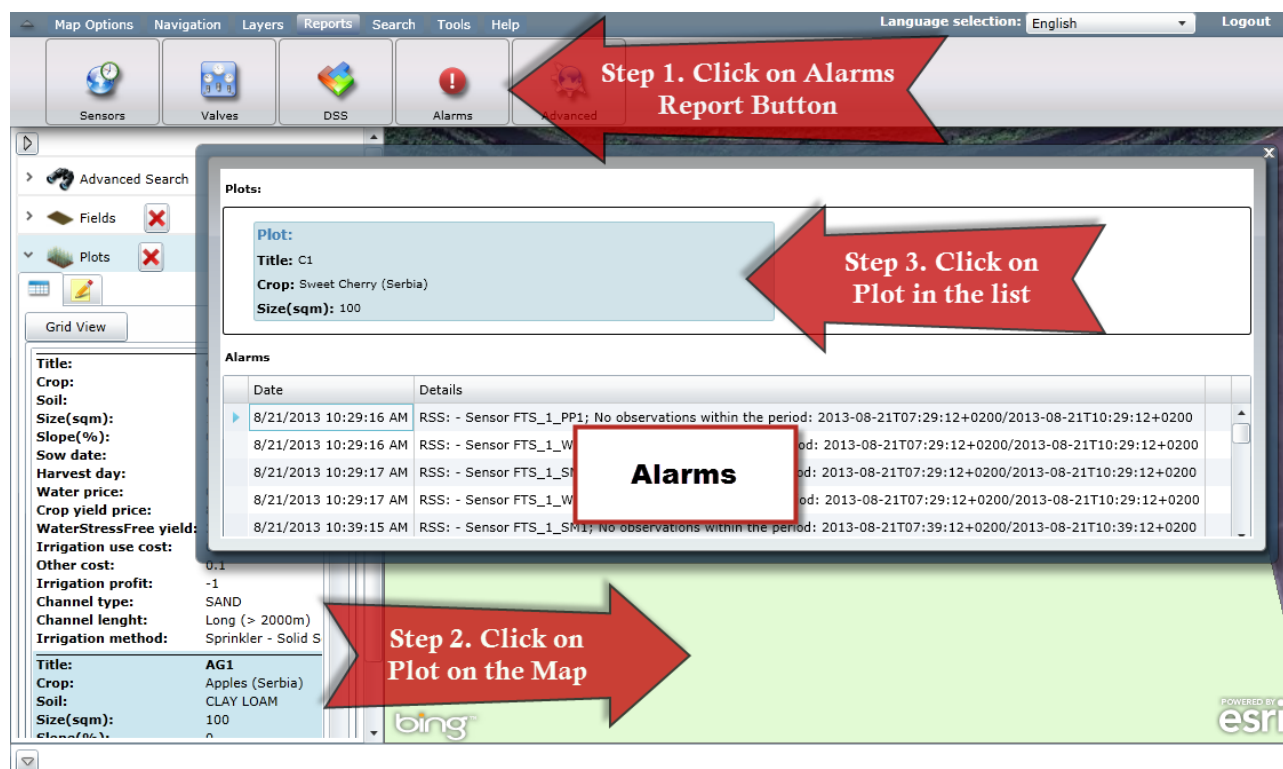


Figure 85 – Alarms Report

4.5.5 View Water Report

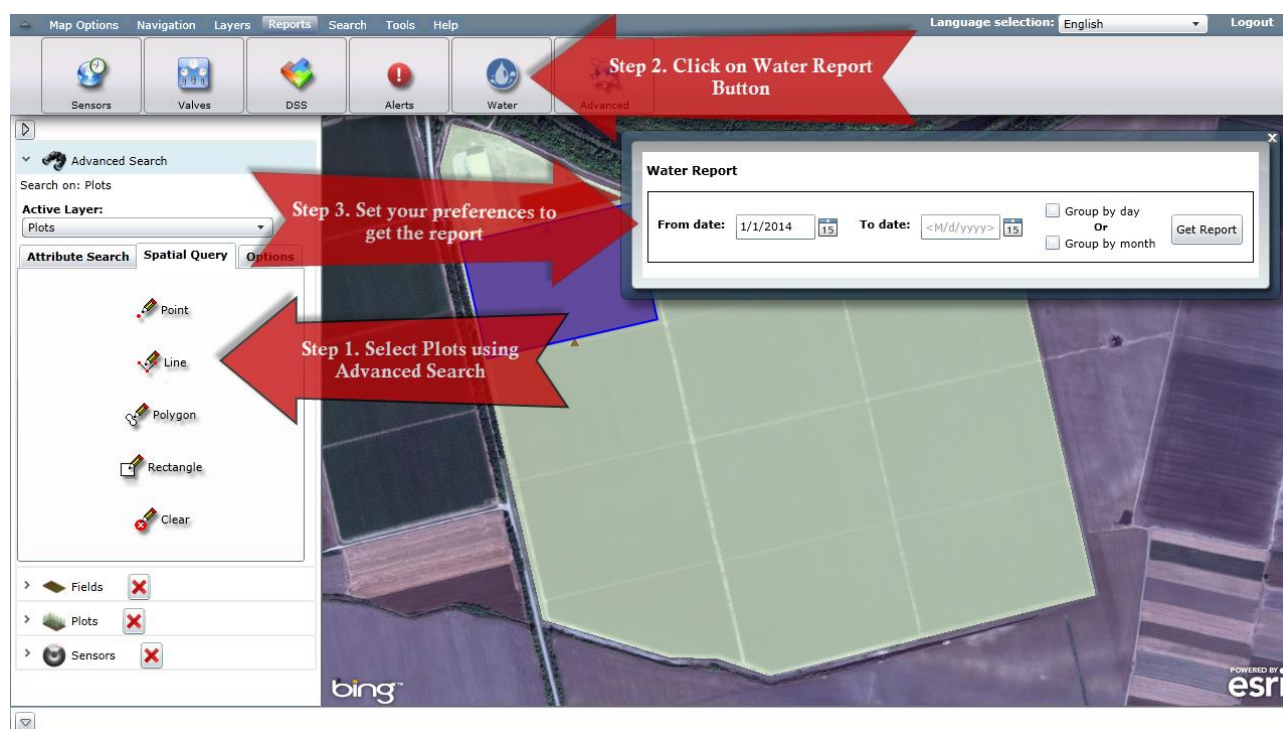


Figure 86 – Water Report

4.5.6 View Advanced Report

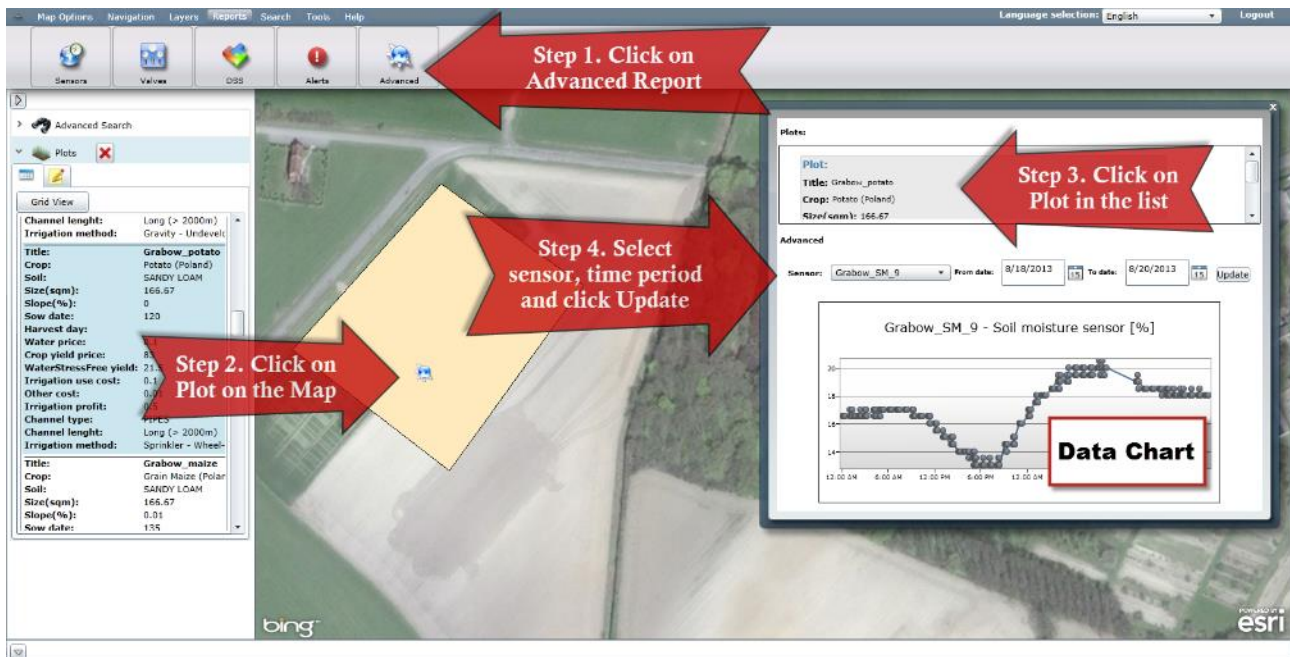


Figure 87 – Advanced Report

4.6 Search

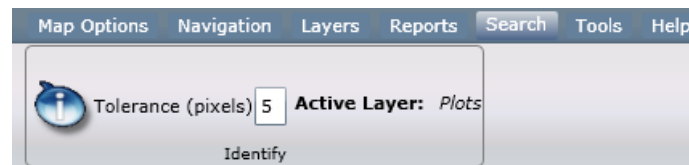


Figure 88 – Search Menu

- **Identify:** This tool allows you to click on the map in order to get information about features in that location. Identify works on a specific ENORASIS layer which is the active layer. The active layer can be set in the advanced search tool which is located in Panel 2.

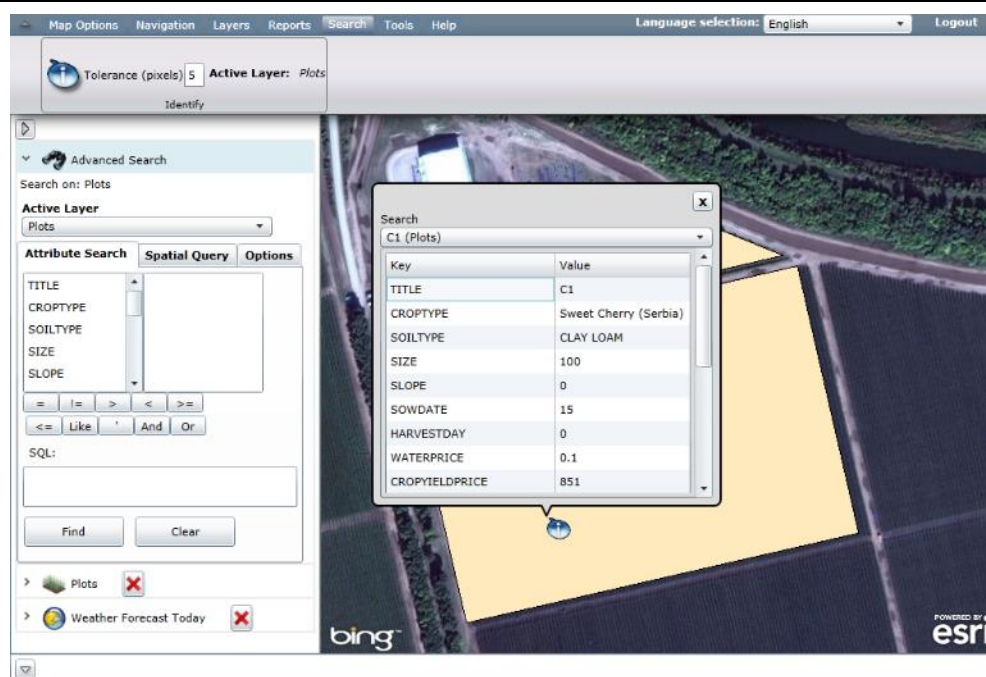


Figure 89 - Identify

- Advanced Search: This tool is located in Panel 2. It provides an interface in order to Query ENORASIS layer features using attributes or spatial selection.
 - Attribute query: This tool allows you to create a SQL query using the layer attributes (attribute list is automatically populated when selected the target layer for the layer list).
 - Spatial query: This tool provides you with several tools to interact with the map in order to select features. These features include Point, Line Polygon and Rectangle selection.

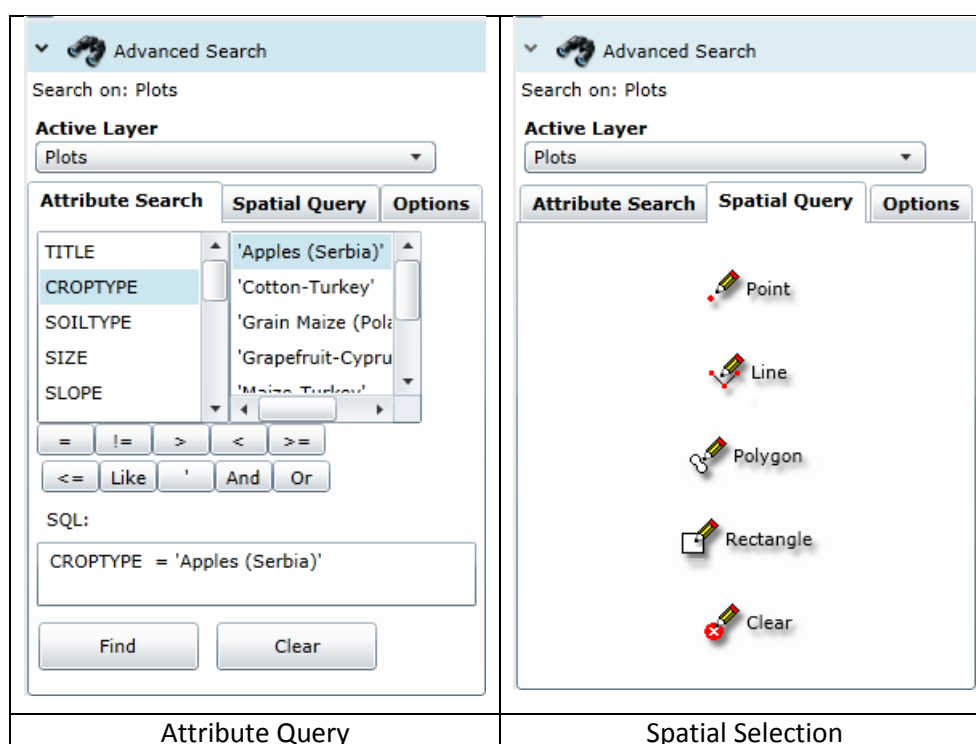
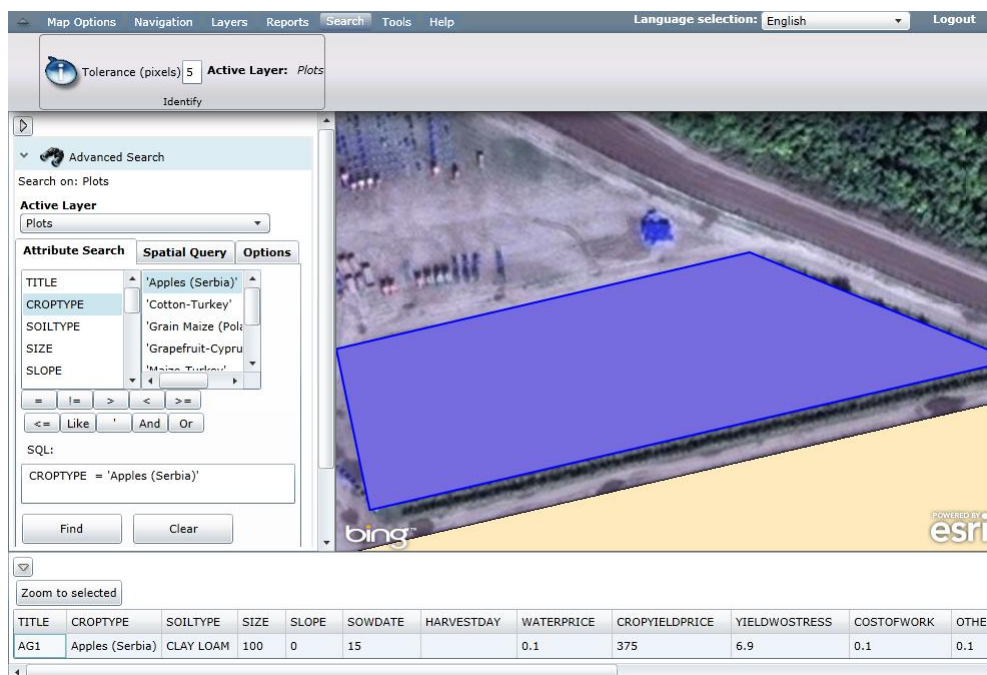


Figure 90 - Advanced Search

The results of the selection are highlighted on the map. A table with the selected features is also automatically displayed.



Advanced Search

Search on: Plots

Active Layer: Plots

Attribute Search: TITLE, CROPTYPE, SOILTYPE, SIZE, SLOPE

Spatial Query: 'Apples (Serbia)', 'Cotton-Turkey', 'Grain Maize (Pol)', 'Grapefruit-Cypru', 'Maize-Turkey'

Options: =, !=, >, <, >=, <=, Like, And, Or

SQL: CROPTYPE = 'Apples (Serbia)'

Find, Clear

Zoom to selected

TITLE	CROPTYPE	SOILTYPE	SIZE	SLOPE	SOWDATE	HARVESTDAY	WATERPRICE	CROPYIELDPRICE	YIELDWOSTRESS	COSTOFWORK	OTHER
AG1	Apples (Serbia)	CLAY LOAM	100	0	15		0.1	375	6.9	0.1	0.1

Figure 91 - Advanced Search Results

4.7 Tools

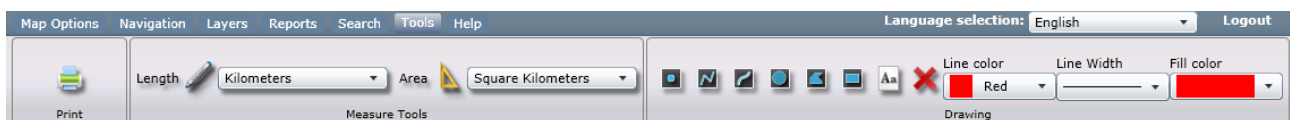


Figure 92 – Tools Menu

- **Print:** Print the Map. You can select print layout from different templates, define the scale and the printing area.

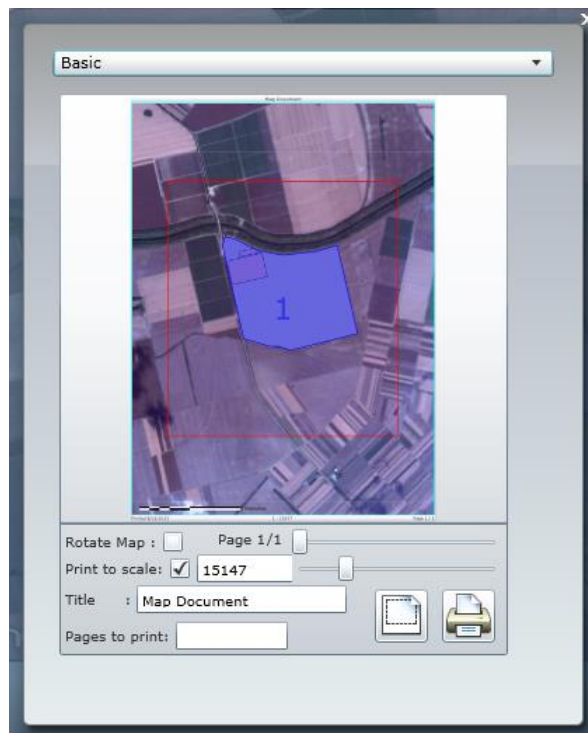


Figure 93 - Print

- **Measuring Tools:** This tool measures length or area by clicking on the map.



Figure 94 - Measure

- Drawing tools: This tool draws on the map point, line, free line, circle, polygon, rectangle or text. You can define the line color, the line width and the fill color.

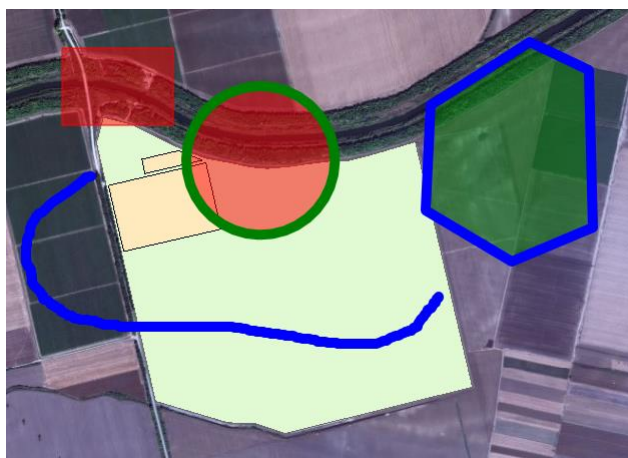


Figure 95 - Draw

4.8 Help

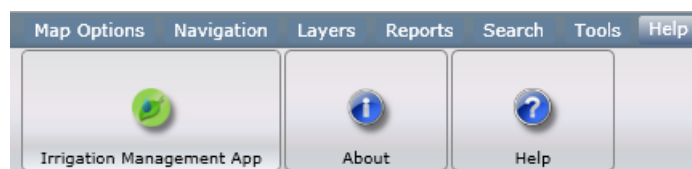


Figure 96 – Help Menu

- Irrigation Management App: Through this button the User can access to the “Web Application” (paragraph 2).



Figure 97 – Irrigation Management

- About: Display information about the project.



Figure 98 - About

- Help: Display a short video explaining the functionality of the "DSS Based on GIS Tool".



Figure 99 - Help

5. ANDROID APPLICATION

5.1 Login screen and main menu

First of all the User has to log into the application with a unique Username and password. If the combination of Username and password matches to a User of the system, the main menu screen will be shown (Figure 100). The main menu allows the User to access the fields he has the appropriate rights to access to. Other options of this menu are:

- see the weather report for a specific field,
- check irrigation reports and events,
- subscribe to an email/SMS system of alarms,
- setting generic configuration parameters (cost of work, cost of water...) and
- exit the application.

These activities will be further explained in the following chapters.

Selecting the "Remember me" option will keep User and password filled by default any time the application is launched, while selecting the "Show password" option the password will be shown in clear characters.

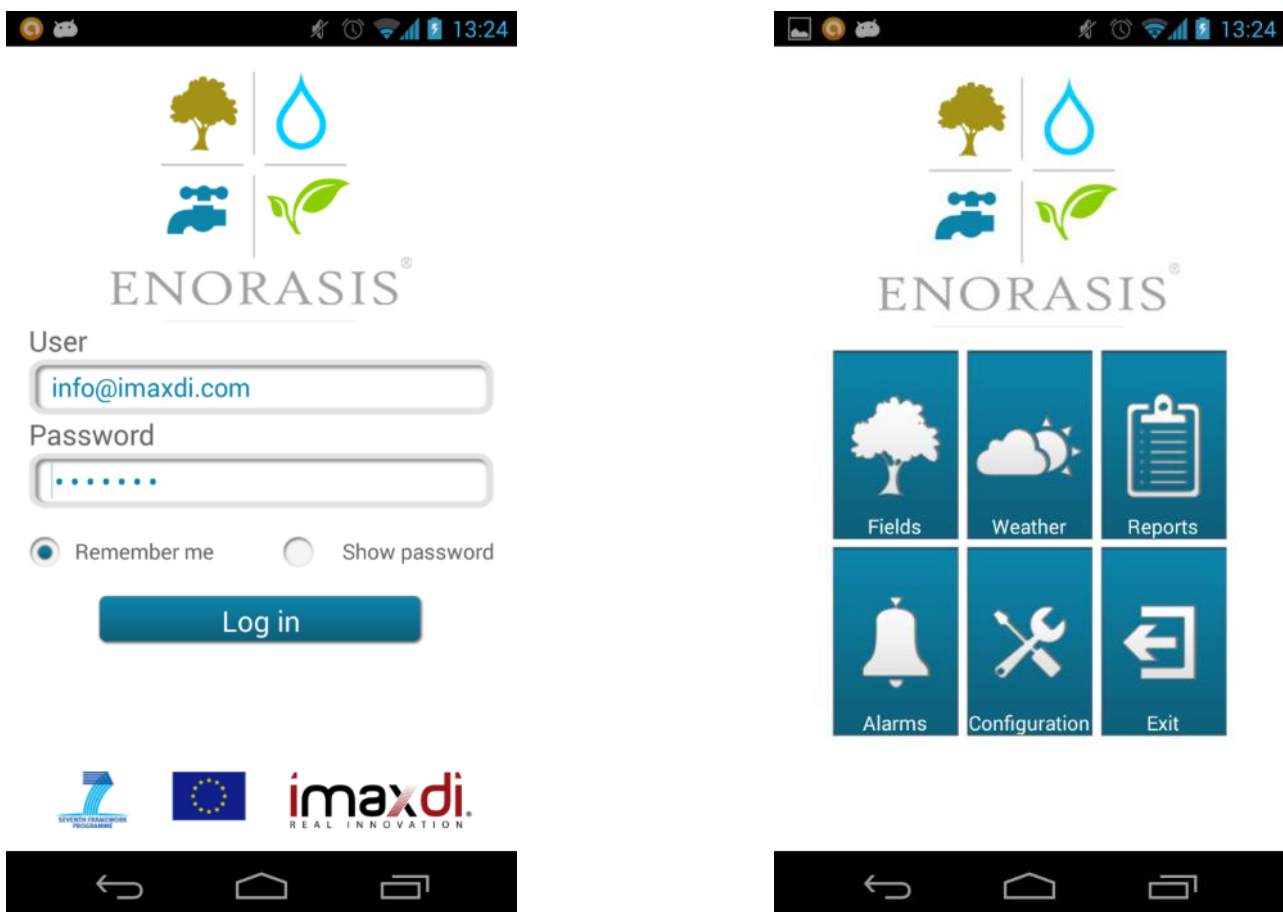


Figure 100 - Login and Main menu screens

5.2 View Weather Forecast

Pressing the "Weather" button in the main menu the User can see a weather report for each field. The predictions can be made to a maximum of 1, 2 or 3 days. The data shown in these reports (Figure 101) are: precipitation probability and amount, wind speed, solar radiation, relative humidity and minimum/maximum temperature.

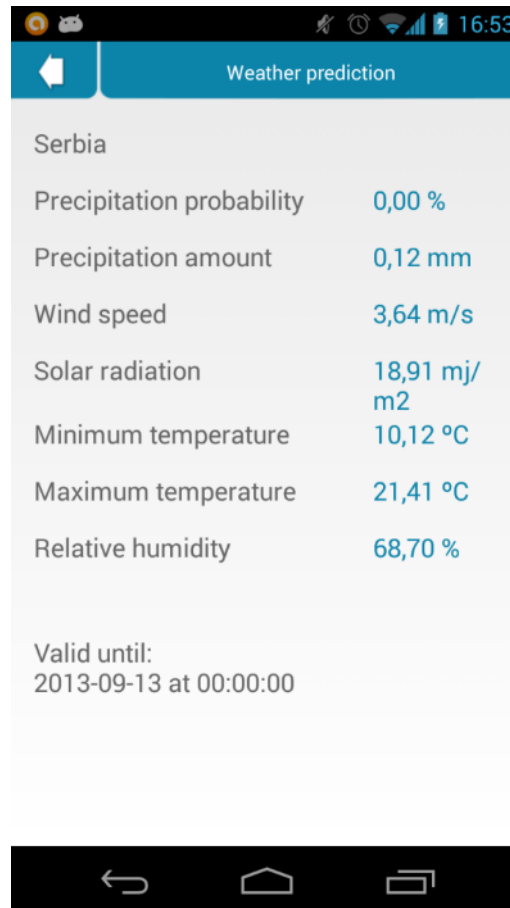


Figure 101 - Weather Prediction screen

5.3 View Reports

Pressing the "Reports" button in the main menu, the User will obtain access to information about the status of his plots. A submenu (Figure 102) will allow the User to select "Irrigation reports" or "Events". The former will show a summary of the Irrigation plans of all the plots belonging to a selected field, the latter will show any error event that have taken place into the fields that belong to the User.

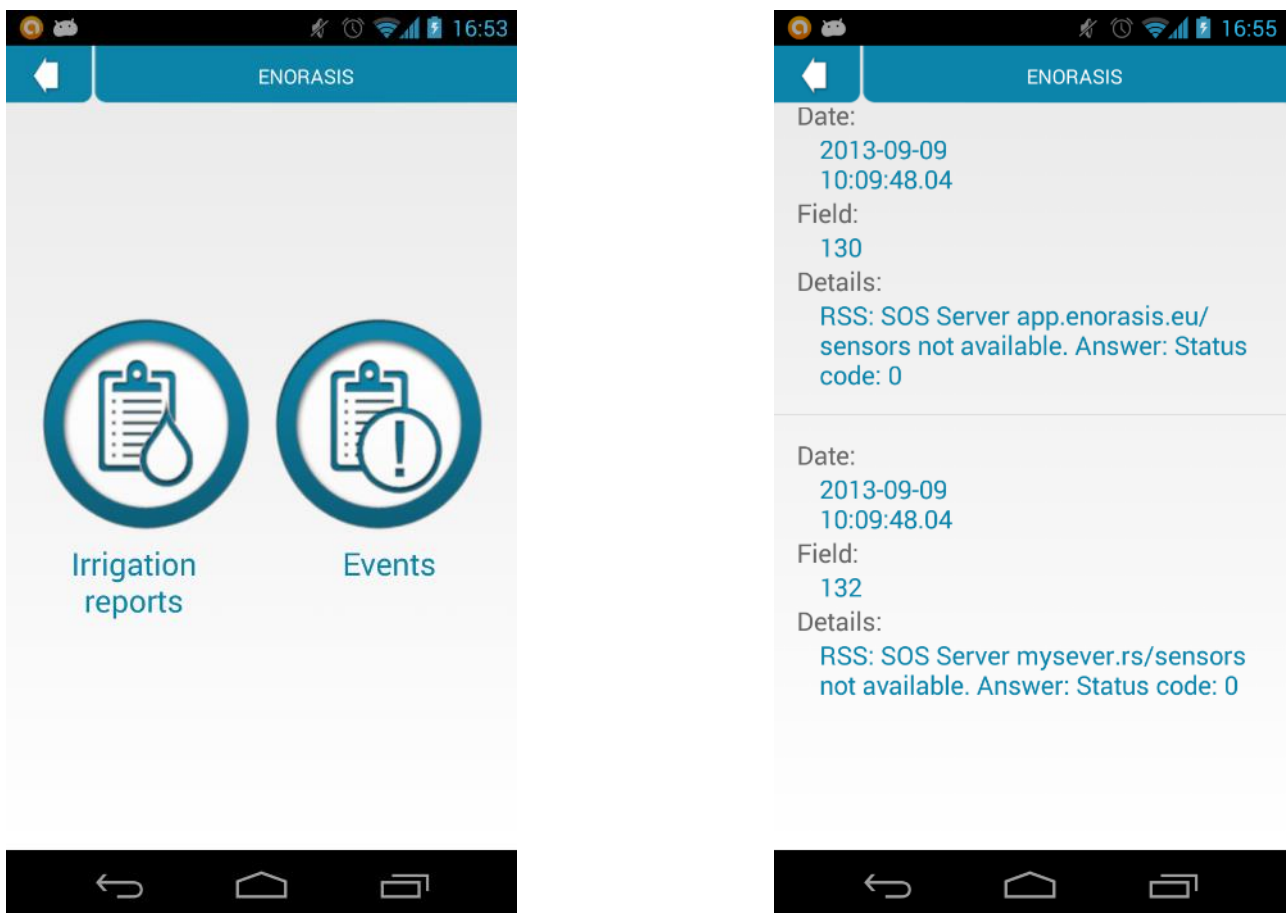
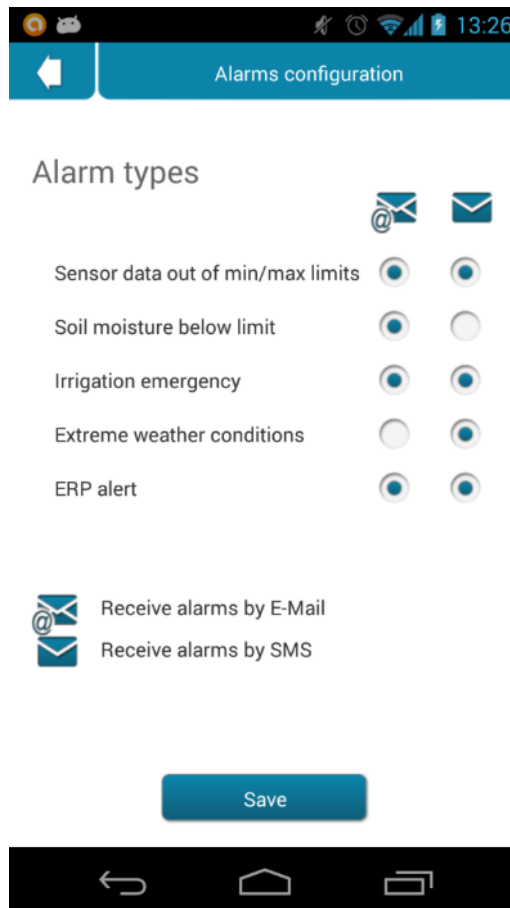


Figure 102 - Reports menu and Events screens



5.4 Retrieve Alarms



Pressing the "Alarms" button in the main menu, the User can manage which kind of alarms he wants to receive and how to receive them. The possible alarms are: "extreme weather conditions", "sensor data out of min/max limits", "irrigation emergency", "soil moisture below limit", and "ERP alerts". For each of the alarm types he can subscribe to receive them by email, SMS or both, pressing the corresponding buttons (Figure 103).



Alarms configuration

Alarm types

		
Sensor data out of min/max limits	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Soil moisture below limit	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Irrigation emergency	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Extreme weather conditions	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ERP alert	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

 Receive alarms by E-Mail
 Receive alarms by SMS

Save

Figure 103 - Alarms screen

5.5 Create field

Pressing the "Fields" button in the main menu (Figure 100), the User will access a list of his available fields. Pressing the button "Create" he will obtain a blank form (Figure 104) where he can fill the attributes of the field to create. To add the geographical coordinates of the field the User must press "GPS boundaries", this way a map will be presented in which the User can select a number of points to define the polygon that defines the field.

If the mobile embedded GPS is not active at that moment, the application will ask the User either to activate it or not, if the User decides not to use the GPS the application will try to calculate the position from the network information, although the accuracy will be higher using GPS.

To create the boundaries of the field the User must move to one of the corners of the field and press the "Get" button, then move to another corner of the field and press "Get" again, then, a line will be drawn in between those two points. This process will continue till all the corners of the field are defined. The minimum number of points the User should capture is three, whenever three points are selected a polygon will be drawn and any new point will be added as a polygon vertex. At any time the User can delete the last point pressing the "Del" button.

Once three points are defined, the User may use the button "Accept" to save the boundaries and get back to the creation interface, where, he should fill the remaining parameters of the field. Finally the User must press the "Save" button to create the field in the system.

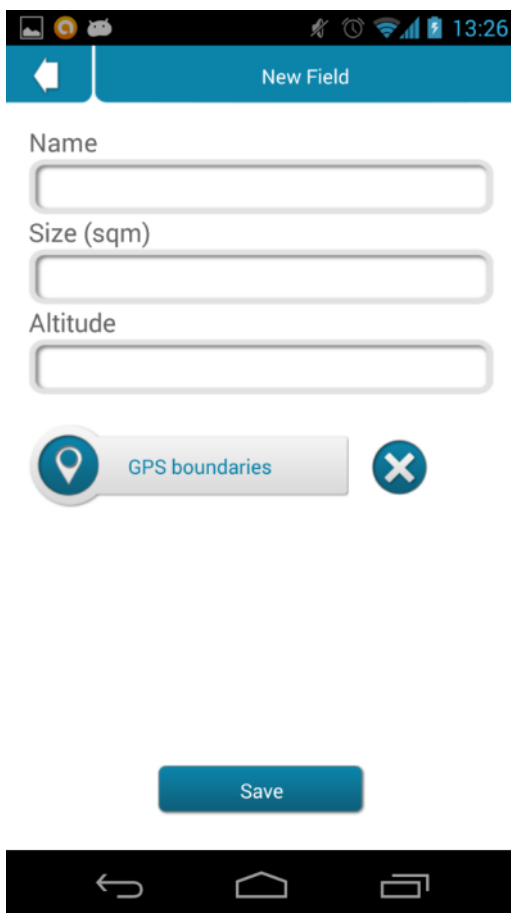



Figure 104 - Field data and GPS points screens

5.6 Search field

If the User wants to work with an existing field he will select one from the list (Figure 105) obtained after pressing the "Fields" button in the main menu (Figure 100). To find a specific field the User may introduce the name, or part of it, in the Filter text box, the available list of fields will be refreshed any time the User introduce a new letter.

The User will choose one single field and press it. To be sure the field selected is the required one, a map will show the boundaries and position of the field. Pressing "Select" the application will show the field menu (see Figure 105), where the User has the following options:

- See: Shows a read-only interface showing the parameters of the selected field.
- Update: Shows a read-write interface where changing any of the parameters of the field is possible.
- Delete: Deletes the selected field.
- Plots: Gives access to the plots belonging to this field.
- Sensors: Gives access to the sensors belonging to this field.
- Valves: Gives access to the valves belonging to this field.

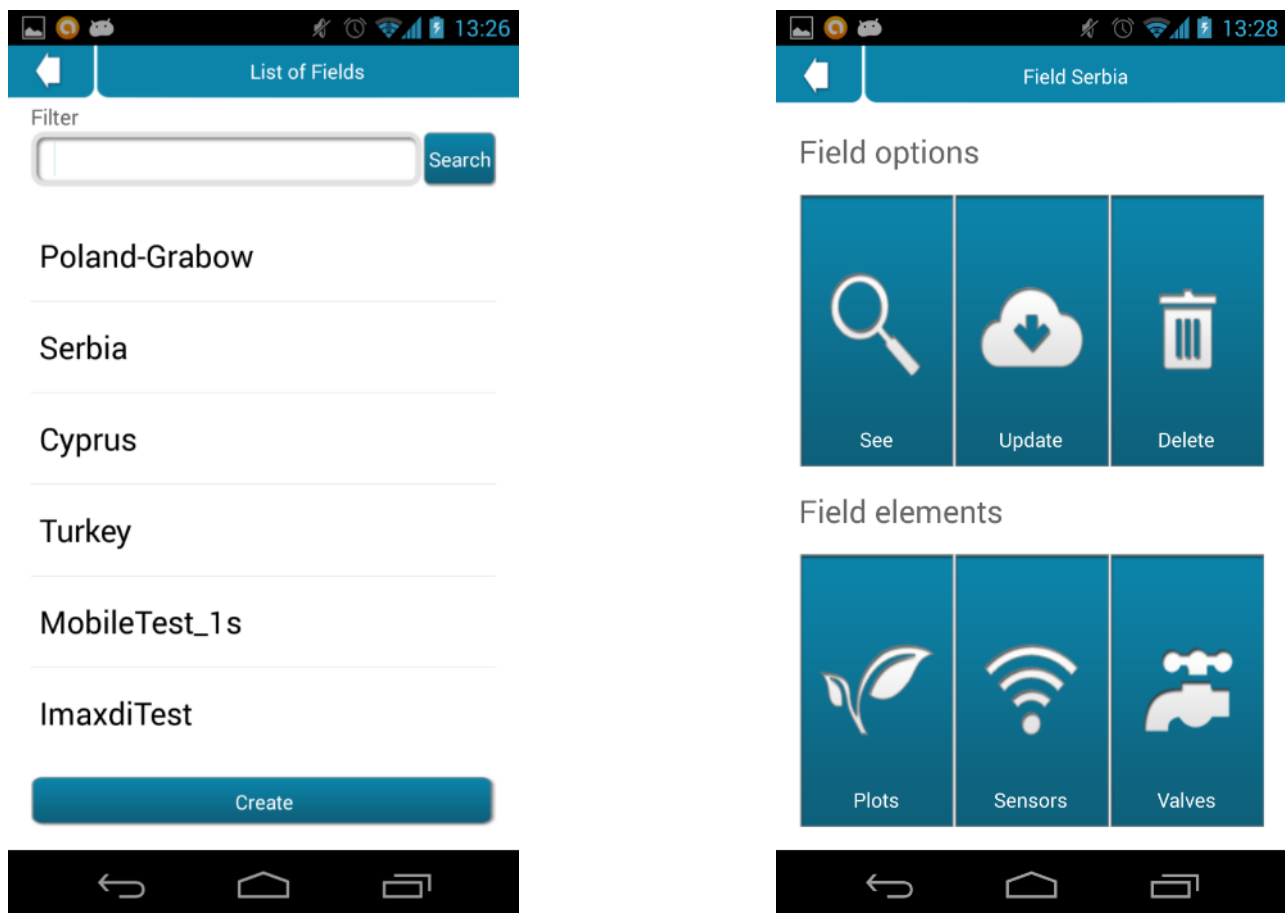


Figure 105 - Field list and Field Options screens

5.7 Create plot

The process to create a new plot is very similar to the one used to create a new field. The User must select a field, as explained in chapter 5.6, and press the "Plots" button in the field menu (Figure 105). When the list of the plots belonging to the field is shown (Figure 106), the User must press the "Create" button to access a blank form where the parameters of the plots should be filled. Since the creation of a plot has a lot more attributes than a field, some of them can be preconfigured in the configuration screen (Figure 106) clicking on "Configuration" button in the main menu (Figure 100). These values will be considered as default in the plot creation screen, being the User able to change them if required.

To add the geographical coordinates of the plot the User must press "GPS boundaries", a similar screen than the one described in chapter 5.5 for the creation of a field is shown, the process to define the boundaries of the plot is exactly the same described there for the field.

Once three points are created, the User may use the button "Accept" to save the boundaries and get back to the creation interface, where, once all the data are filled, the User must press the "Save" button to finally create the plot in the system.

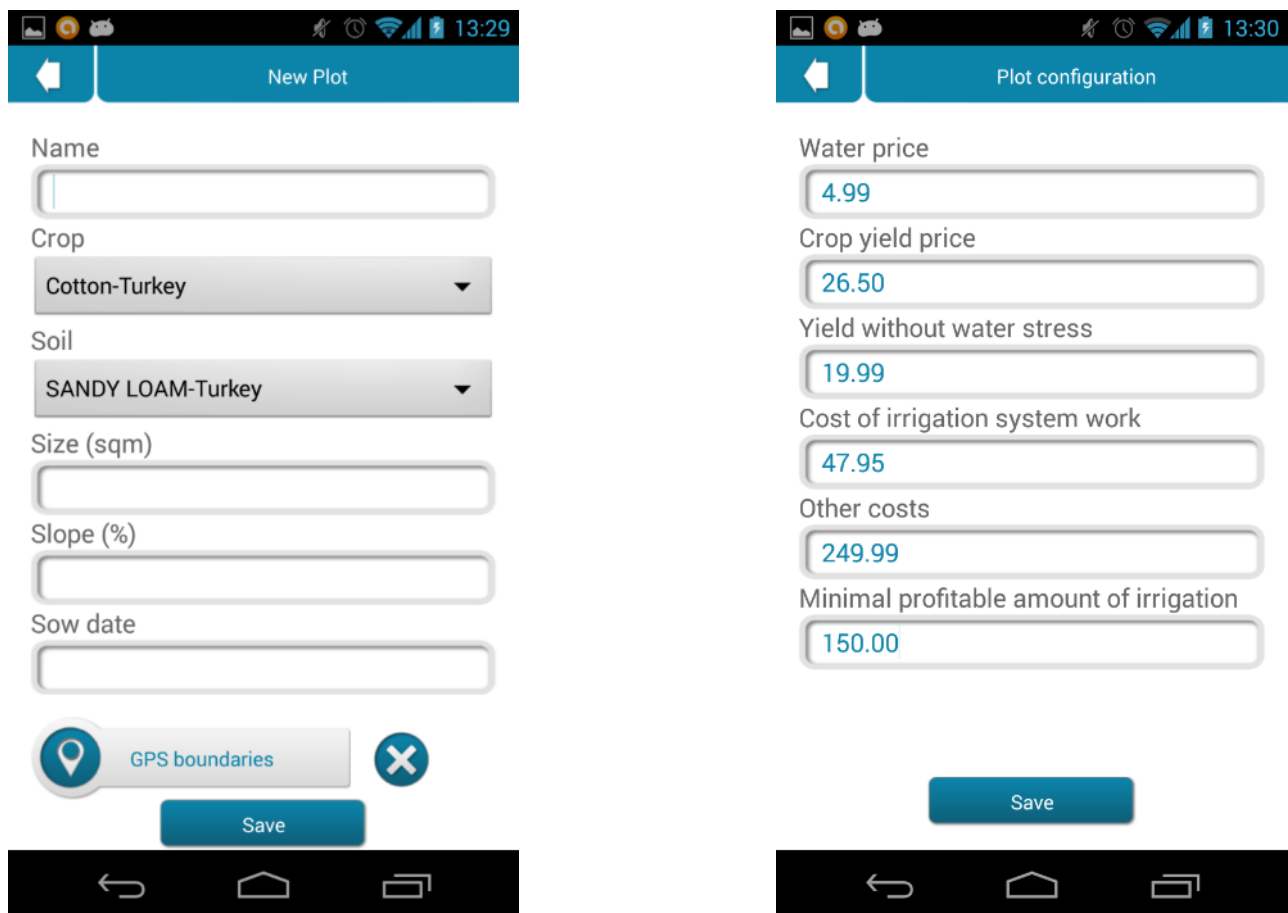


Figure 106 - Plot Data and Plot Configuration screens

5.8 Search plot

Working with an existing plot is also possible. Once the User has accessed the list of plots belonging to a field (Figure 107), pressing the "Plots" button of the field menu (see Figure 105& Figure 106), the User has just to select one of them clicking on it or using the filtering capability as explained in 5.6 for fields. As in the fields' case, a map will show the plot (a green polygon) inside his field (a blue polygon). If the User accepts the selection clicking on the "Select" button, the application will show the plot menu (see Figure 108), where the User has the following options:

- See: Shows a read-only interface showing the parameters of the selected plot.
- Update: Shows a read-write interface where changing any of the parameters of the plot is possible.
- Delete: Deletes the selected plot.
- Irrigation: Gives access to the irrigation plan of the selected plot.
- Sensor-readings: Gives access to the measures obtained by all the sensors of the plot.
- Valve-values: Gives access to the amount of water poured by all the valves in the plot.

In the irrigation plan screen (Figure 108) the User can consult the latest result of the Decision Support System of ENORASIS, which includes the amount of water planned to irrigate and the values for moisture and effective precipitation. Also, information about the status of the irrigation plan, which can be:

- Inactive
- Active and immediately executable
- In progress (water is flowing)
- Pending (irrigation was interrupted)

- Finished

The irrigation plan can be "Enabled" or "Disabled" which can be changed with the buttons "ENABLE auto" or "DISABLE auto".

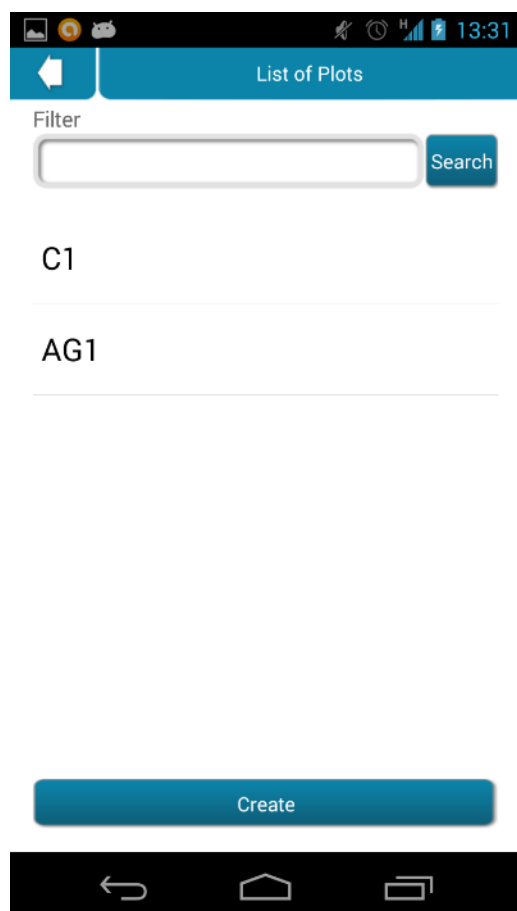


Figure 107 - Plot list and Plot map screens

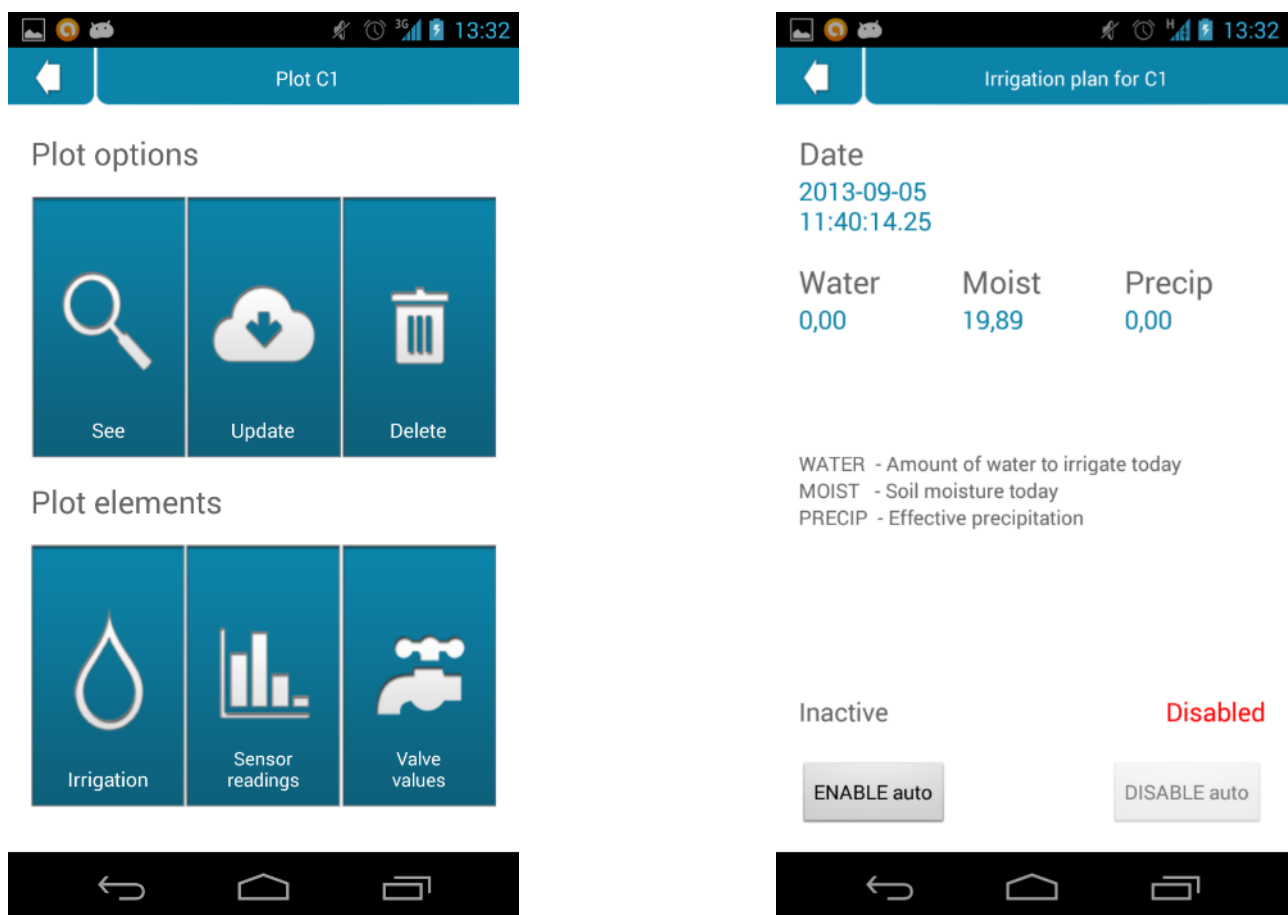


Figure 108 - Plot Options and Irrigation Plan screens

5.9 Create and assign Sensors or Valves

The User can create sensors or valves following a similar procedure of a plot creation, from the field menu (Figure 105), "Sensors" or "Valves" button must be selected. A list of sensors or valves will be shown with the existing ones for the current field. If the User clicks on "Create" button, a blank form will be presented to fill (Figure 109).

To add the geographical coordinates of the sensor or valve the User must press "Get GPS location" button, this way a map will be presented in which the User can select only one point to define the location of the sensor or valve.

If the mobile embedded GPS is not active at that moment, the application will ask the User either to activate it or not, if the User decides not to use the GPS, the application will try to calculate the position from the network information, although the accuracy will be higher using the GPS.

For sensors and valves, only one point is needed, so the User must move to the proper location and press the "Get" button once. The User can delete this point pressing the "Del" button and selecting another point. Once the location is the correct one, the User must use the button "Accept" to save it and get back to the creation interface, where the remaining data must be filled.

When creating a sensor or valve, it must be assigned to the plot or plots that they are giving service to. To do this the User must click on the "Set plots" button. Two lists will be presented with the assigned and non-assigned plots (Figure 109). To assign one, the User must click on a plot from the "unsigned plots" list and immediately, the plot will change lists to the "assigned plots" one. To un-assign a plot, the User must do the inverse action and click on a plot from "assigned list". Once the assignments had finished, the User must click on "Save" button to save the assignments and return to the previous form.

To make effective the changes and save the new sensor or valve, the User must click on the "Save" button in the form to create it on the system.

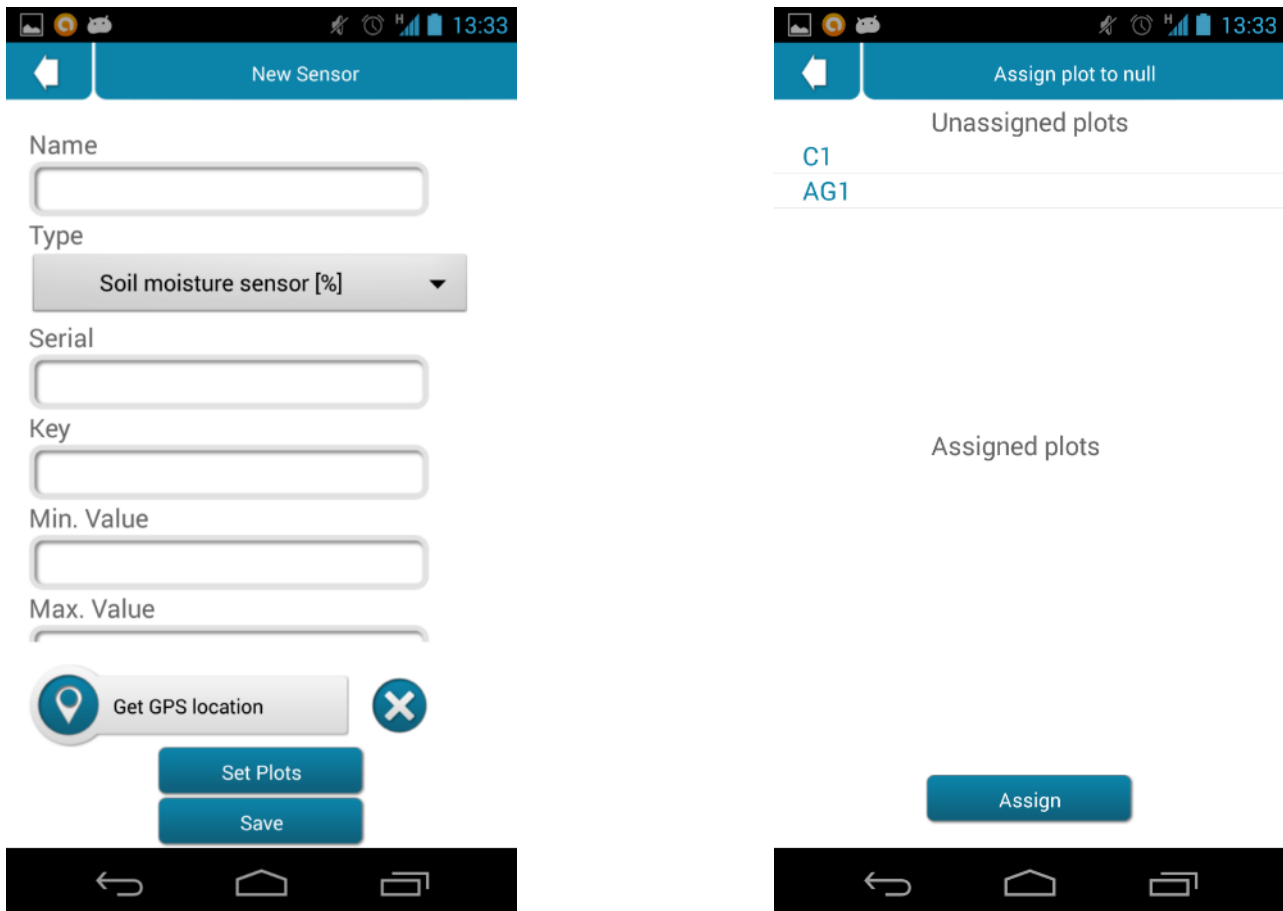


Figure 109 - Sensor Data and Set Plots screens

5.10 Search Sensor

Working with an existing sensor is also possible, choosing an existing sensor in a similar way we did for plots in 5.8. After selecting a field, the User must click on the "Sensors" button on the field menu (Figure 105) and a list will be presented with the related sensors. Filtering options are also available.

Clicking on one sensor, a map will show its position with a yellow marker. If the User accept the selection clicking on the "Select" button the application will show the sensor menu (Figure 110), where the User can choose between:

- See: Shows a read-only interface showing the parameters of the selected sensor.
- Update: Shows a read-write interface where changing any of the parameters of the sensor is possible.
- Delete: Delete the selected sensor.
- Measures: Shows the measures of the selected sensor (Figure 110), these data may be filtered by hours, being 12 hours the maximum available. The measures can be deleted, modified or added as explained in section 5.12.

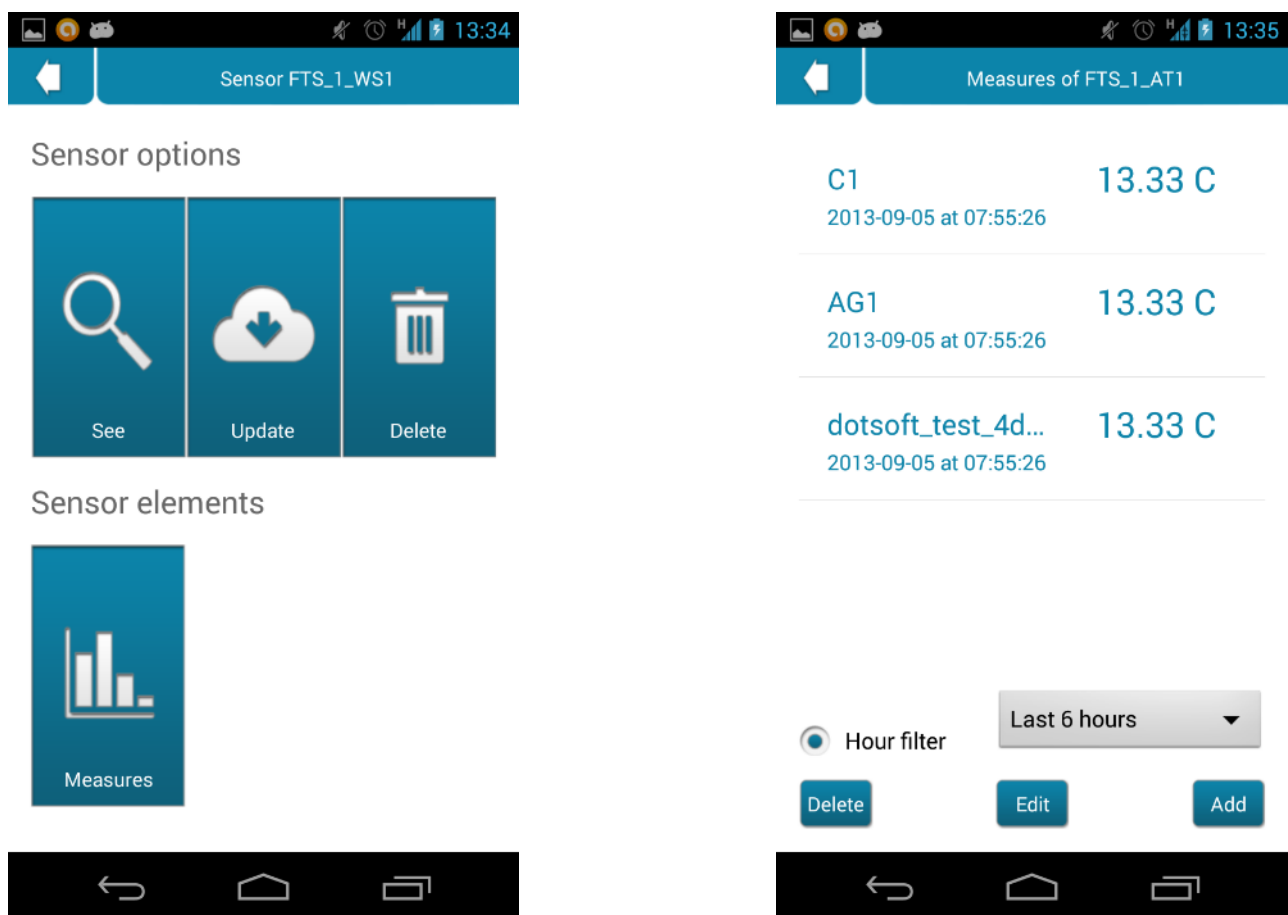


Figure 110 - Sensor Options and Measure Options screens

5.11 Search valve

The User can select an existing valve in a similar way we explained how to search a sensor in 5.10. In the field menu (Figure 105), after selecting a field, the User must click on the "Valve" button to access a list of valves belonging to that field. Filtering options are also allowed.

When the User selects one of the valves by clicking on it, a map will show the valve position with a magenta marker. If the User accepts the selection by clicking on the "Select" button the application will show the valve menu (Figure 111), where the User has the following options:

- See: Shows a read-only interface showing the parameters of the selected valve.
- Update: Shows a read-write interface where changing any of the parameters of the valve is possible.
- Delete: Deletes the selected valve.
- Watering: Shows the status of the valve (Unknown, Closed, Open, Error, waiting to be closed or waiting to be opened). The valve can be started or stopped remotely, using the "start watering" or the "stop watering" buttons (Figure 111).
- Data: Shows the values of the selected valve, these data may be filtered by hours, being 12 hours the maximum available. The values can be deleted, modified or added as explained in section 5.12.

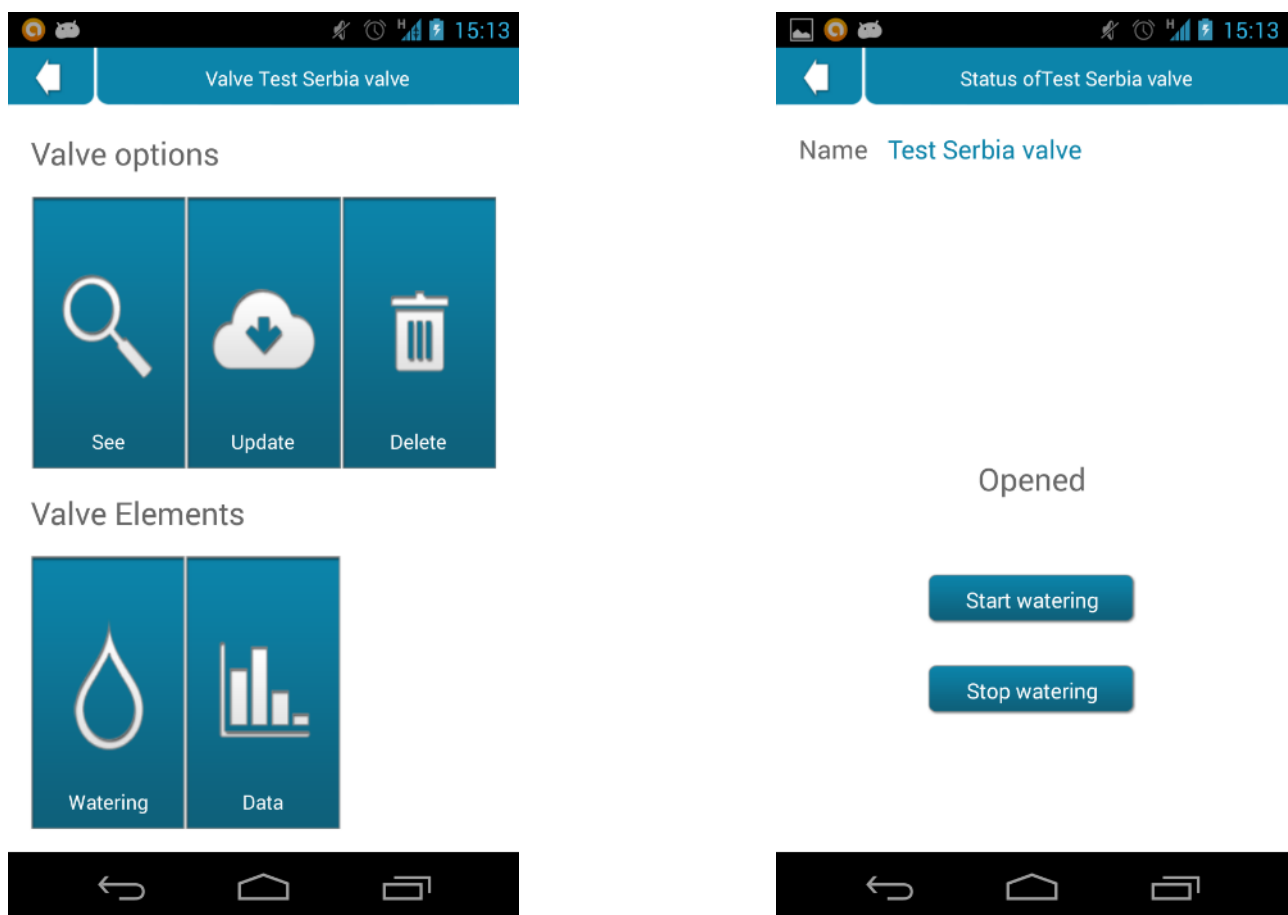


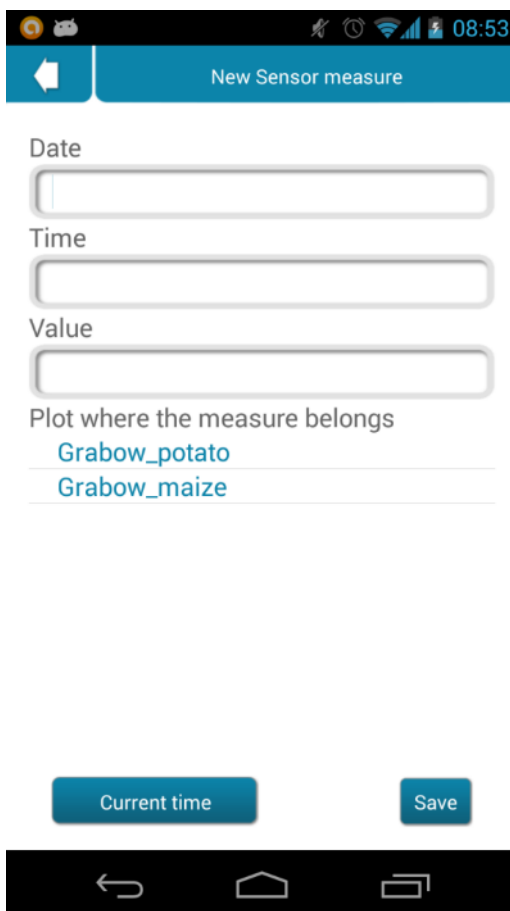
Figure 111 - Valve Options and Valve Watering screen

5.12 Manual inserts of data

The User can add manual measures for the sensors and values for the valves. There are two ways of doing so:

- One is clicking on the “Measures” button in the sensor menu (Figure 110) and on the “Data” button in the valve menu (Figure 111) to see a list of measures and values. If the User selects one of them, he has the possibility of deleting or editing it by clicking on the corresponding buttons. To create a sensor measure or a valve value manually, he must click on the “Add” button to get a blank form for adding a new one (Figure 112). Adding the date and time of the measure may be done manually or by pressing “current time” button to add automatically the current time. After inserting the value, the last step is assigning the measure or the value to a plot, selecting one of the available plots (plots belonging to the initially selected field) in the list at the lower part of the creation screen.
- The second one is selecting “Sensor-readings” or “Valve-values” in the plot menu (Figure 108), the User will be presented with a list of measures or values captured by all the devices assigned to the plot. Editing and deleting elements of that list is also possible in this case. Pressing the “Add” button, will show a blank form for creating a sensor measure or a valve value like before, but in this case, a list of sensor/valves belonging to the initial plot will be shown for the User to assign this brand new reading/value to the corresponding device.

Finally the User must press the “Save” button for the measure or the value to be created in the system.



The screenshot shows a mobile application interface for creating a new sensor measure. At the top, there is a status bar with various icons and the time 08:53. Below it is a blue header bar with a back arrow icon on the left and the text 'New Sensor measure' on the right. The main content area contains four input fields: 'Date', 'Time', 'Value', and 'Plot where the measure belongs'. The 'Date' and 'Time' fields are empty. The 'Value' field is empty. The 'Plot where the measure belongs' field has two options: 'Grabow_potato' and 'Grabow_maize', both in blue text. Below the input fields are two blue buttons: 'Current time' and 'Save'. At the bottom, there is a black navigation bar with three white icons: a back arrow, a home icon, and a recent apps icon.

Figure 112 - New Sensor Measure Creation